

**Figure 1 User Surrounded by Devices and Services**

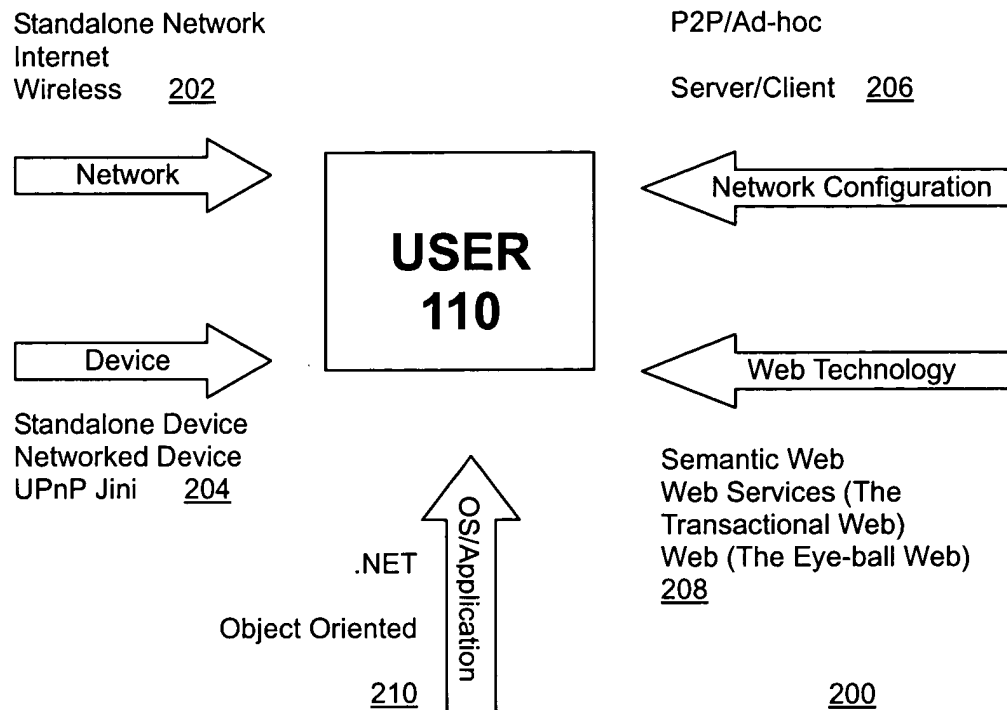
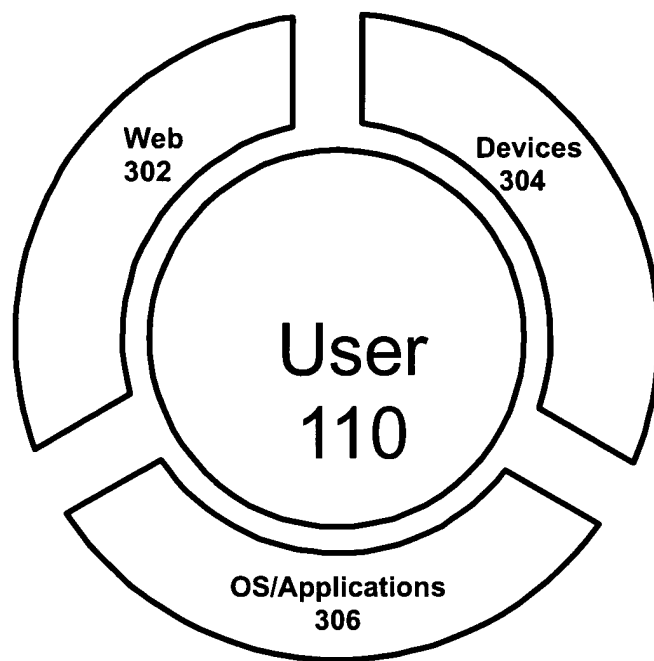


Figure 2 User-centered View (I)



**Figure 3 User-centered View (II)**

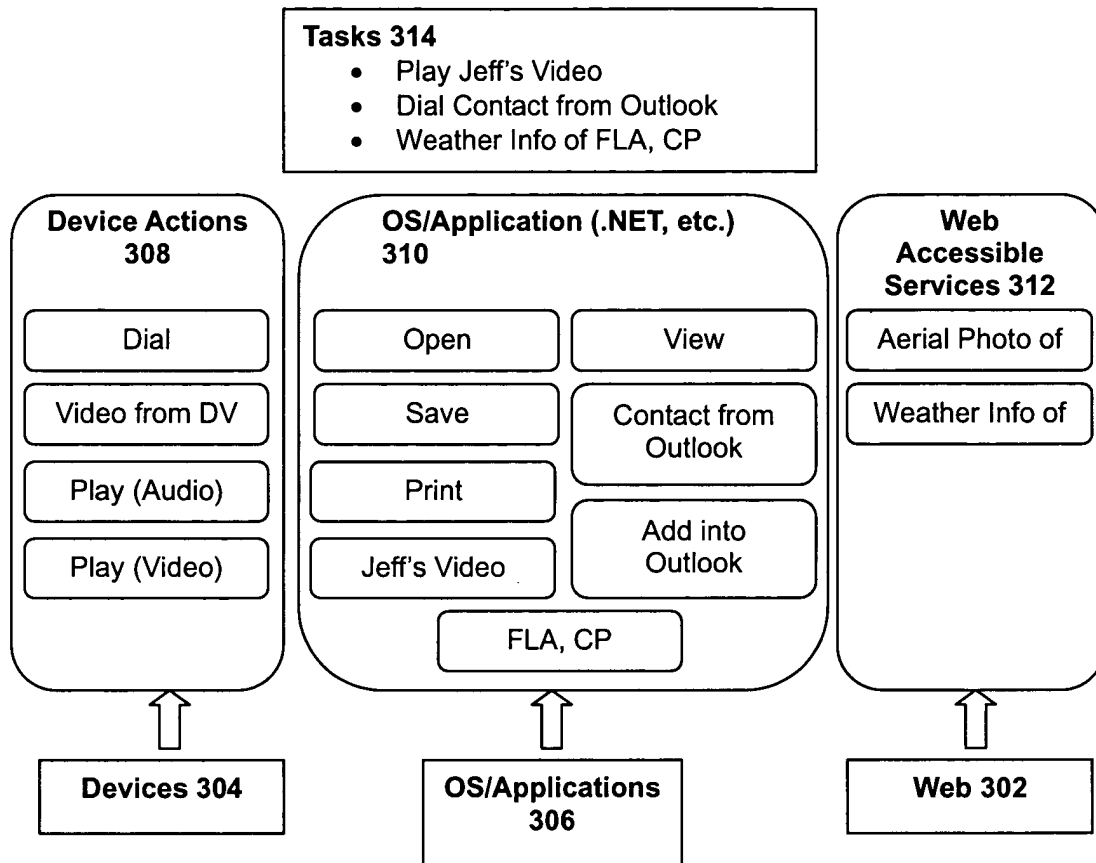
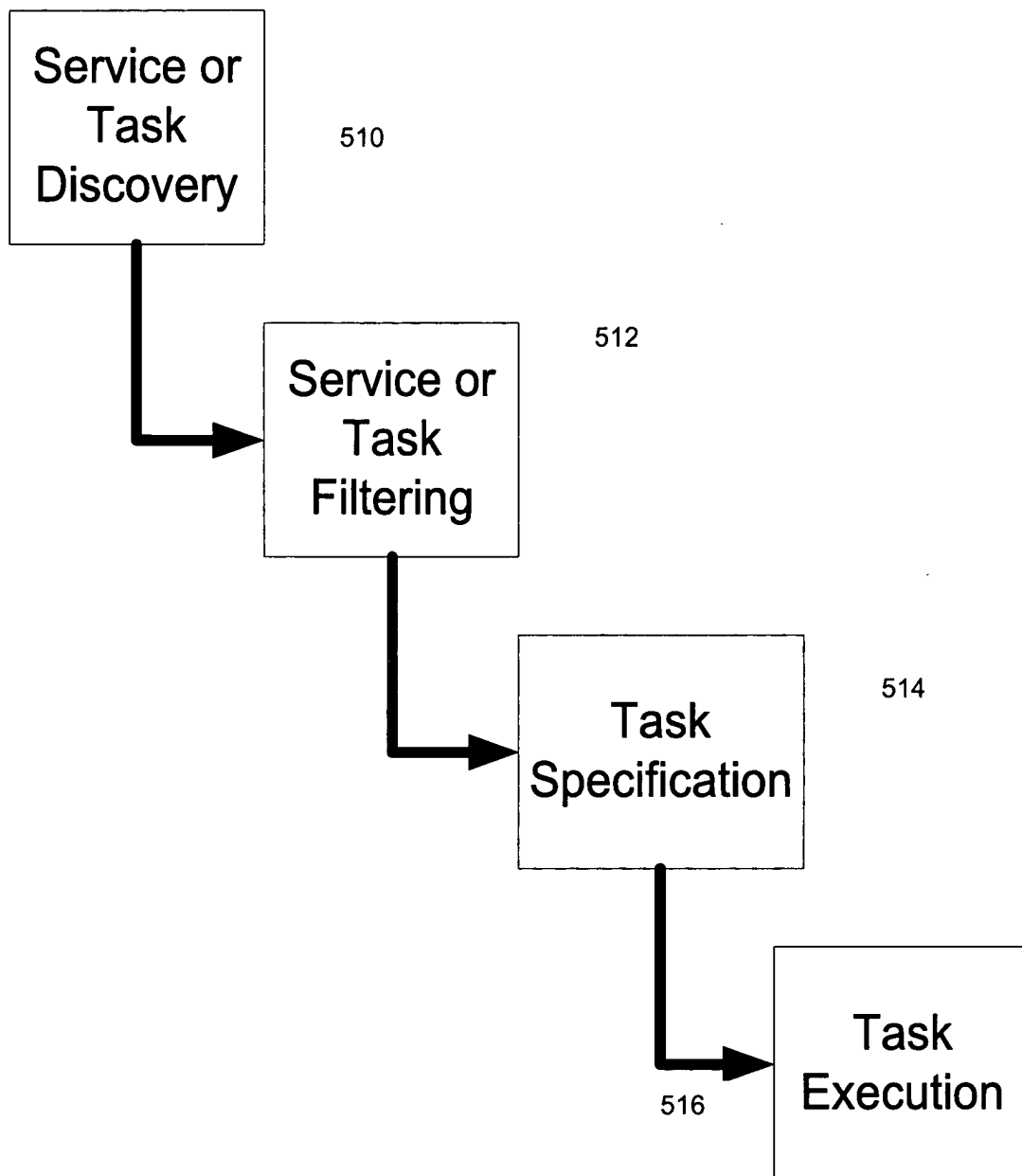
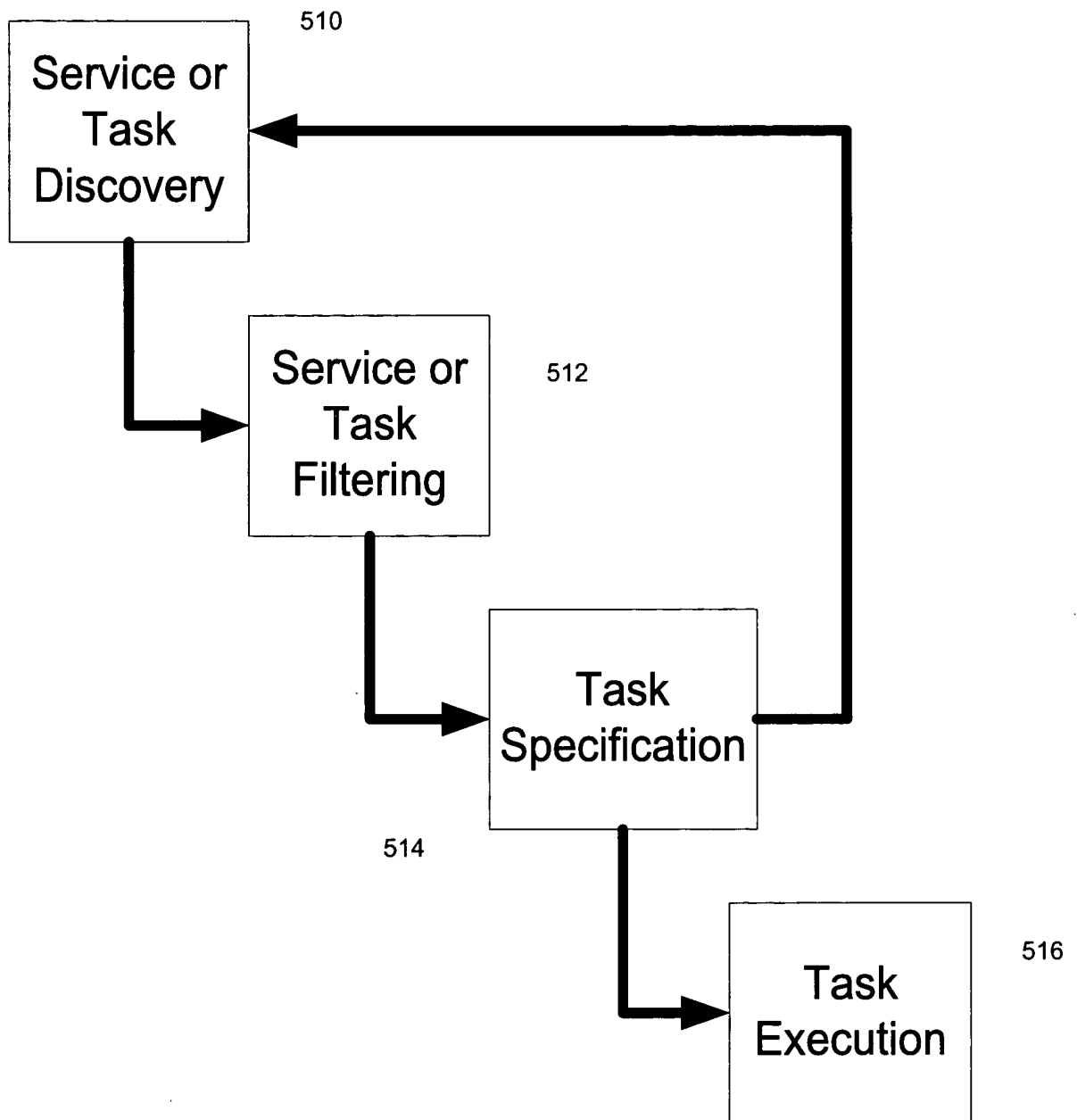


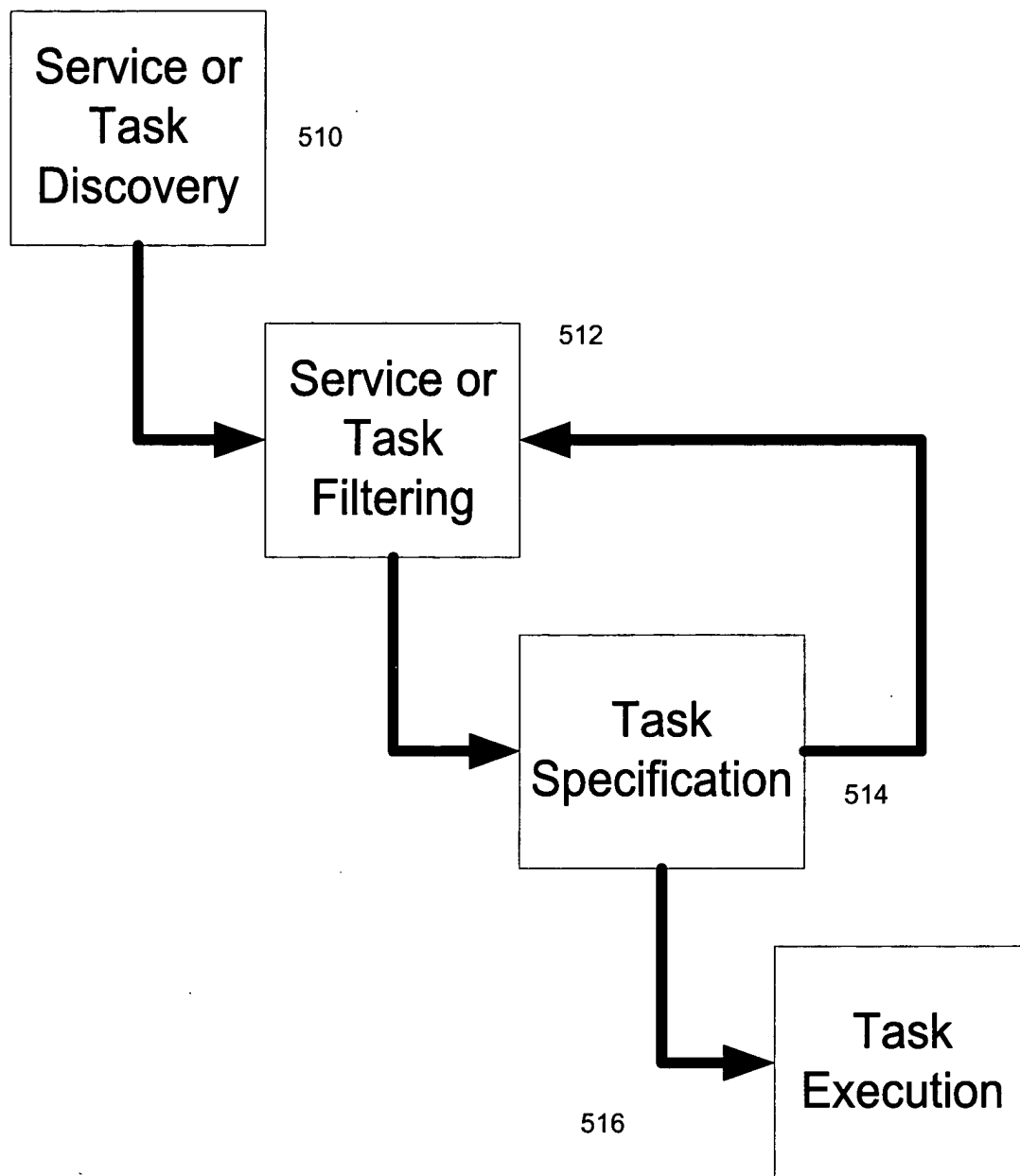
Figure 4 Tasks and Services



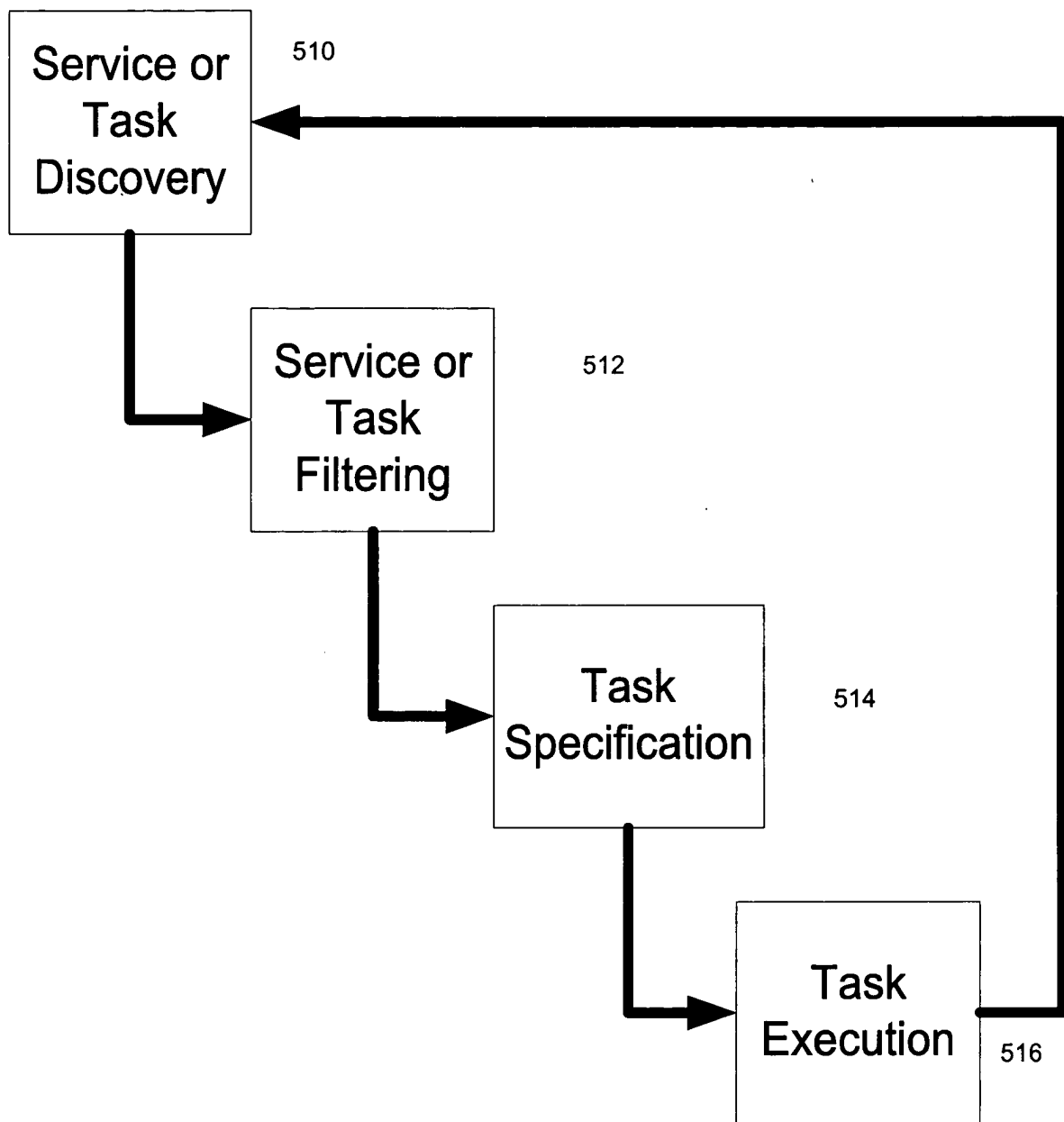
**Figure 5 Task Computing Workflow Variation (I) 500**



**Figure 6 Task Computing Workflow Variation (II) 600**

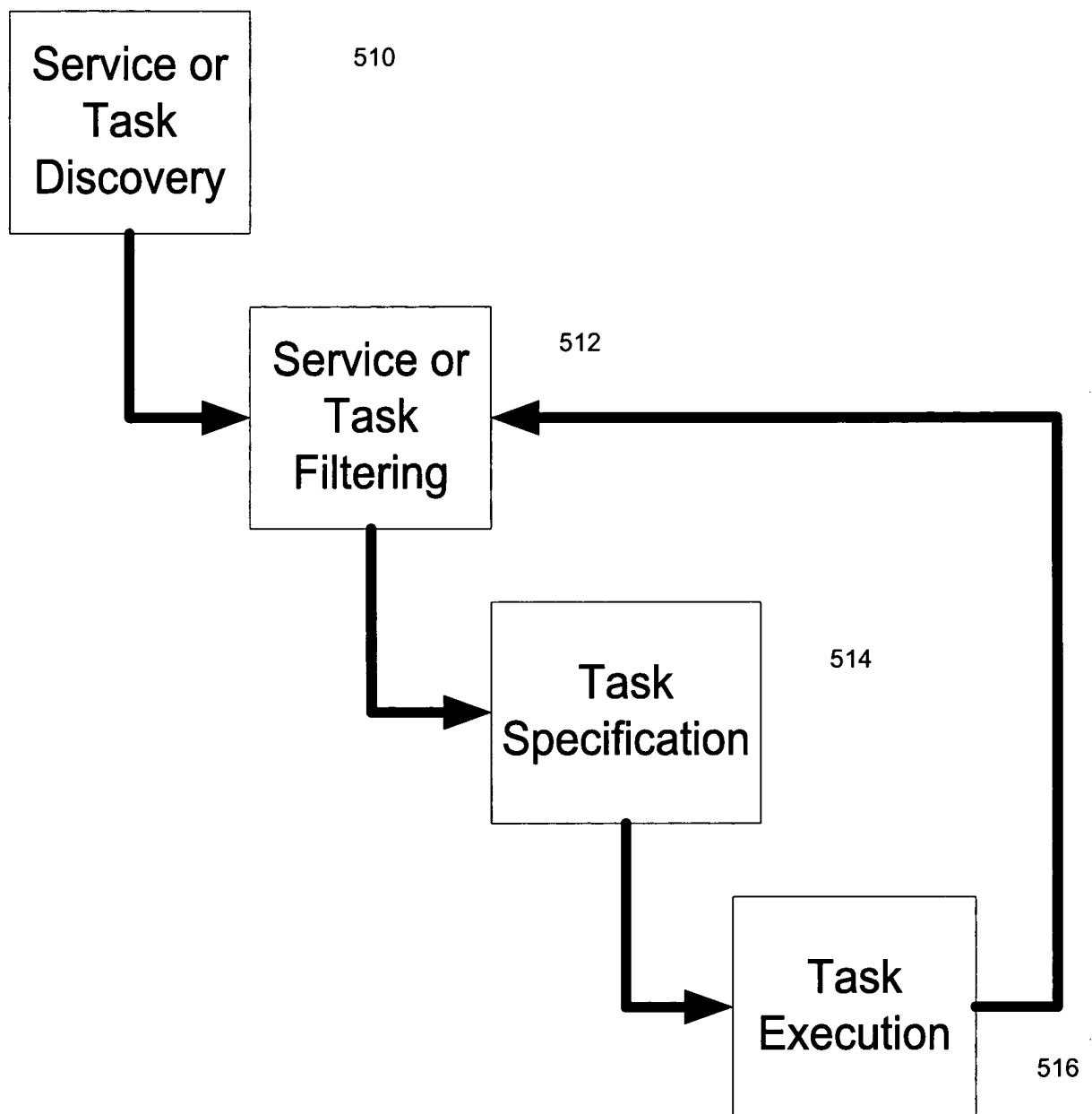


**Figure 7 Task Computing Workflow Variation (III) 700**

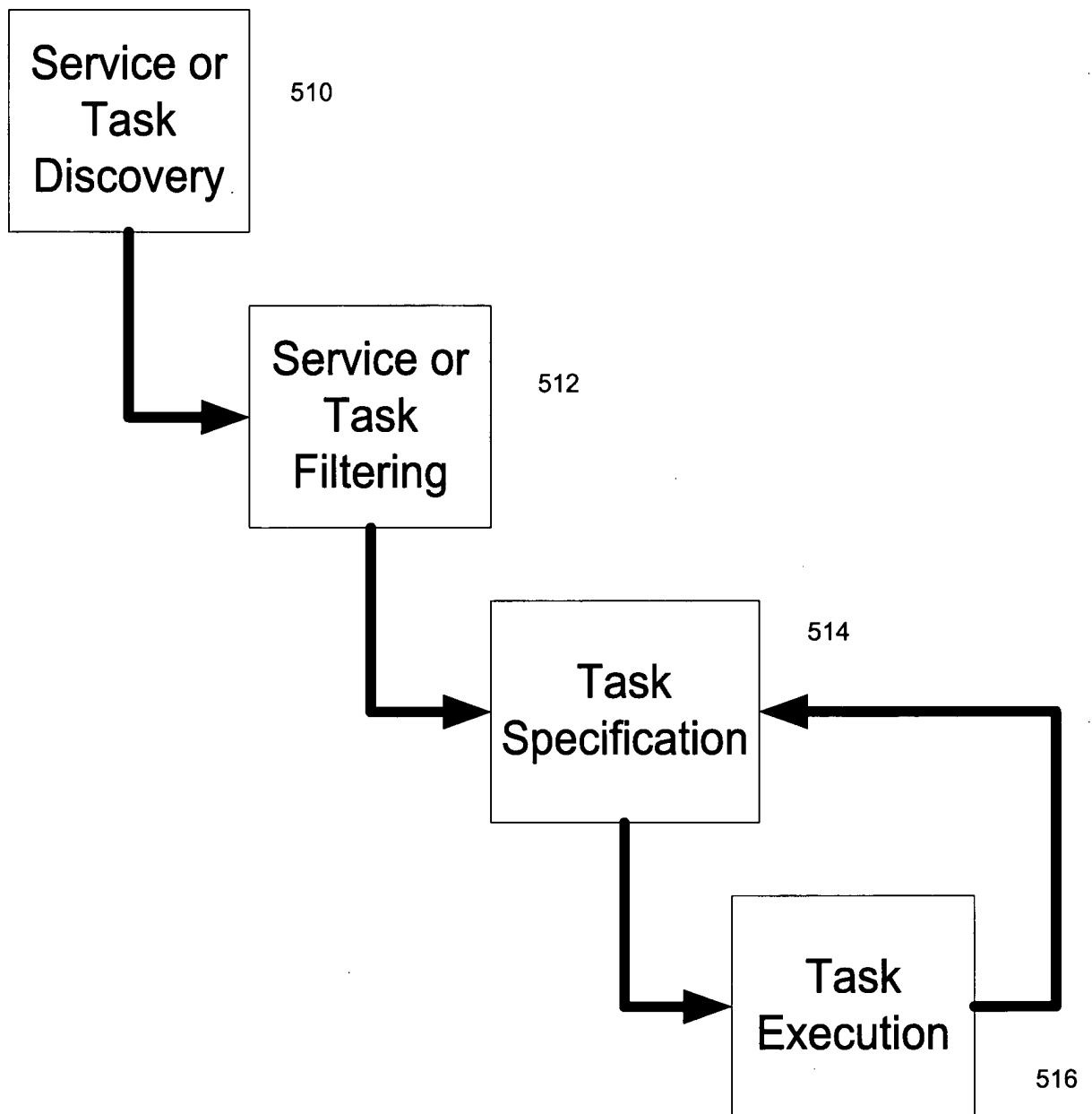


**Figure 8 Task Computing Workflow Variation (IV) 800**

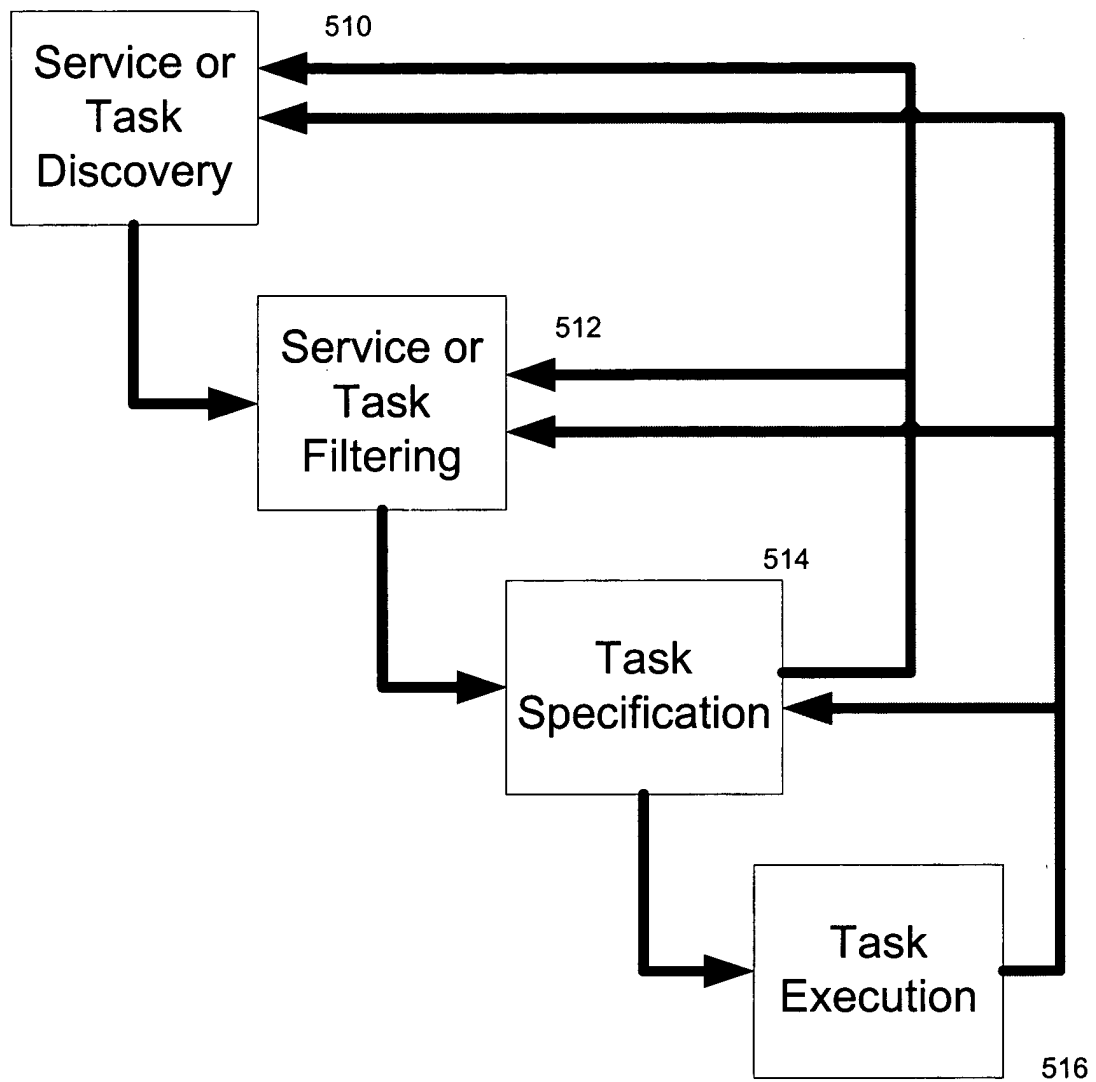




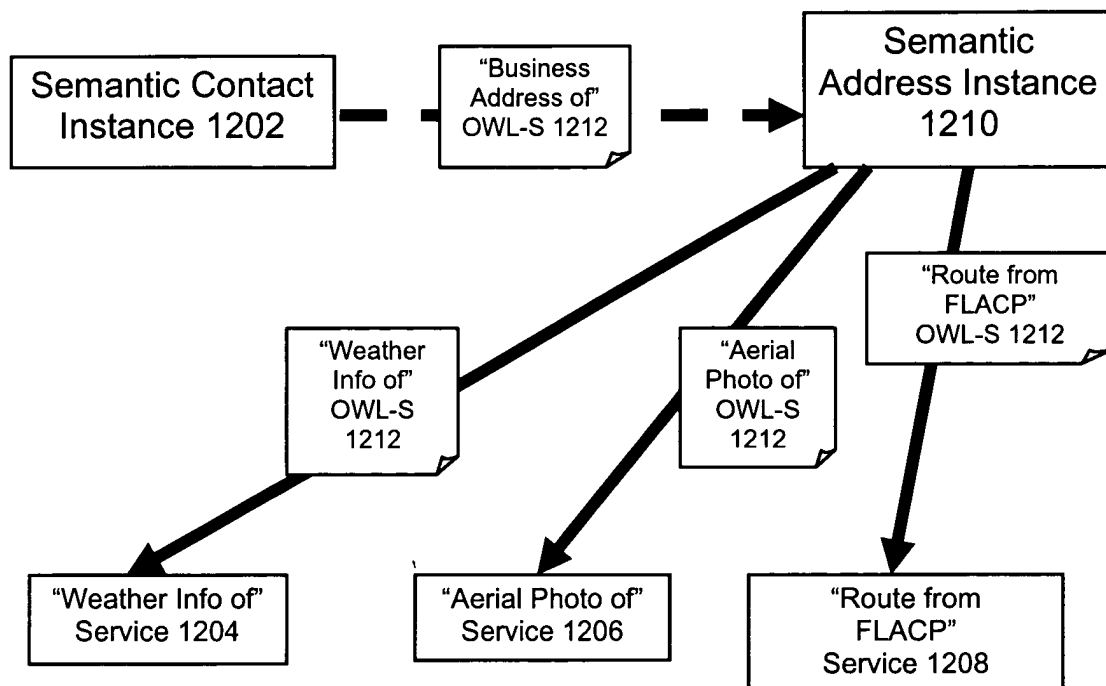
**Figure 9 Task Computing Workflow Variation (V) 900**



**Figure 10 Task Computing Workflow Variation (VI) 1000**



**Figure 11 Composite Task Computing Workflow 1100**



**Figure 12 Semantic Service Instance Mapping and Grounding 1200**

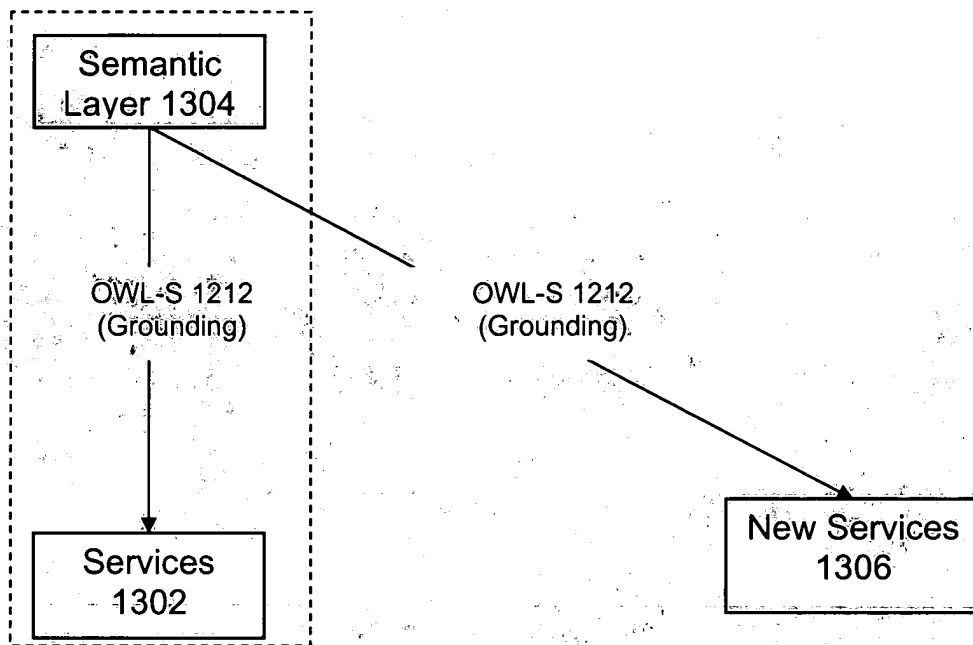
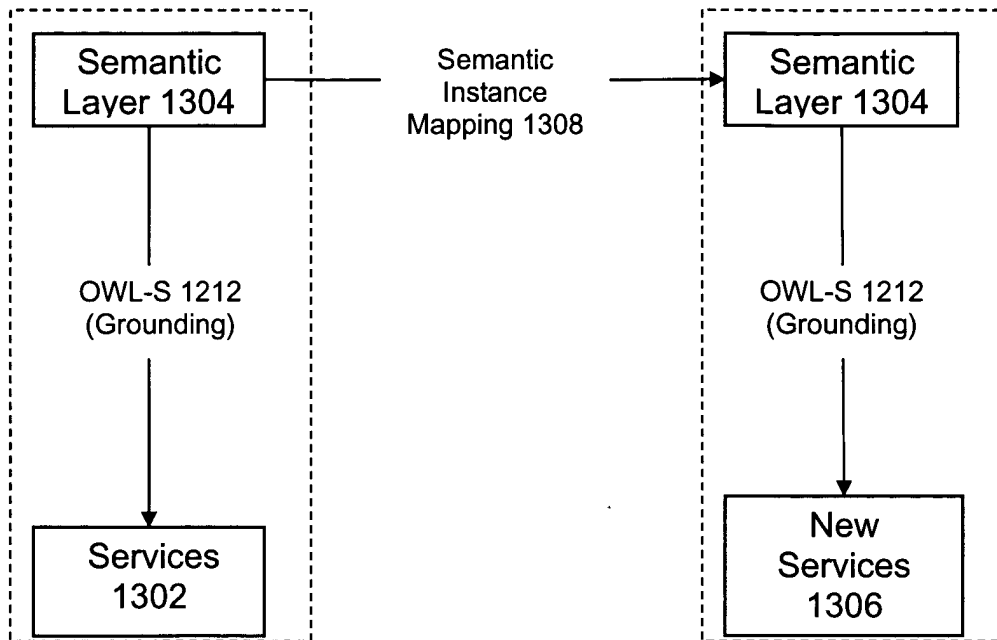
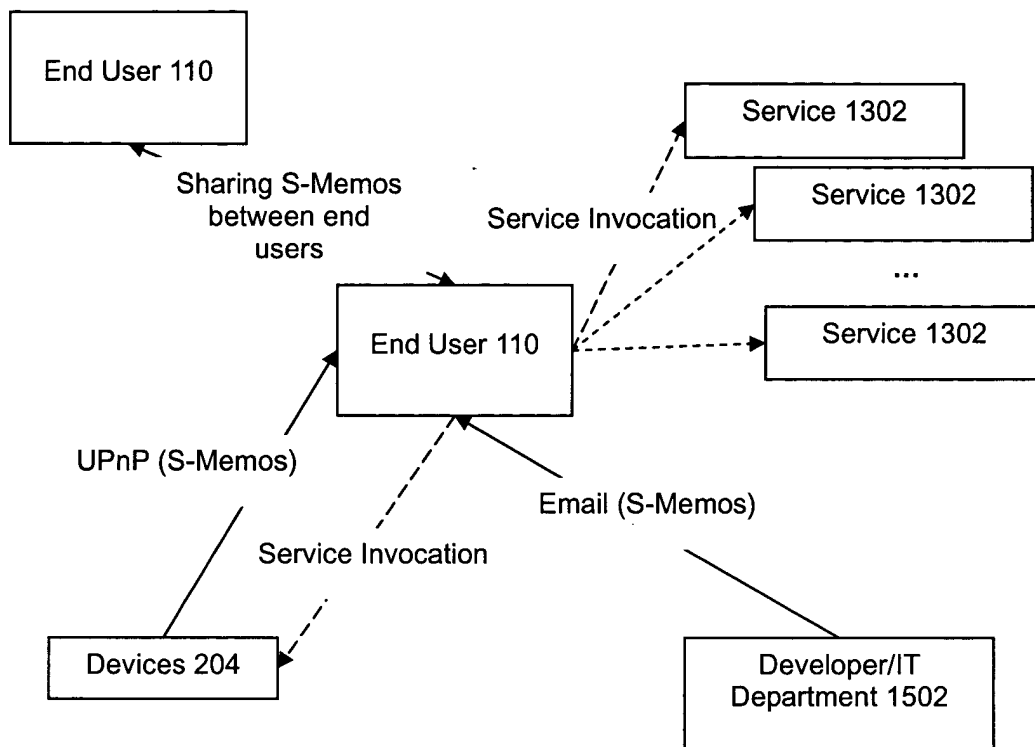


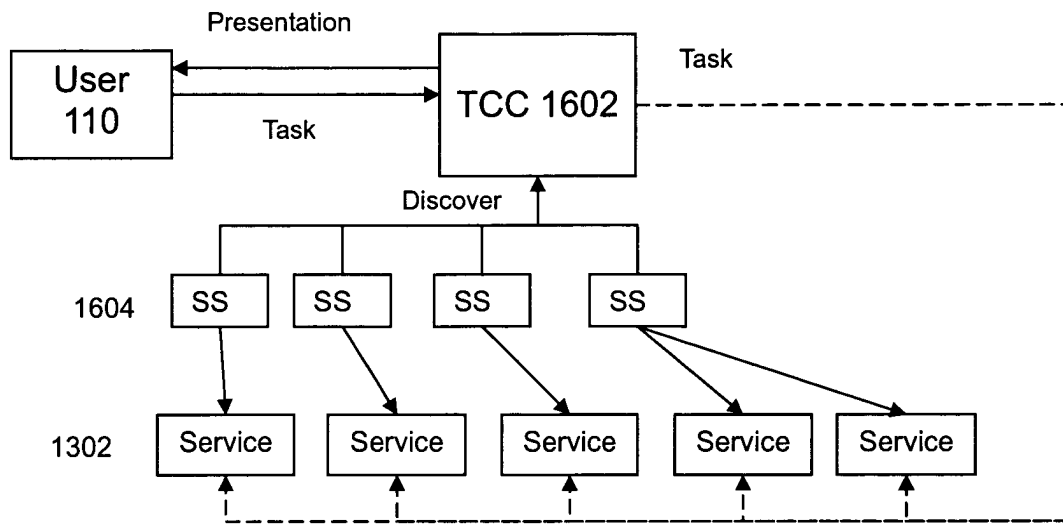
Figure 13 Incorporating New Services (I) 1300



**Figure 14 Incorporating New Services (II) 1400**



**Figure 15 End-user System Development/Deployment Based on S-Memo 1500**



**Figure 16 Generic Architecture of a TCE Embodiment 1600**



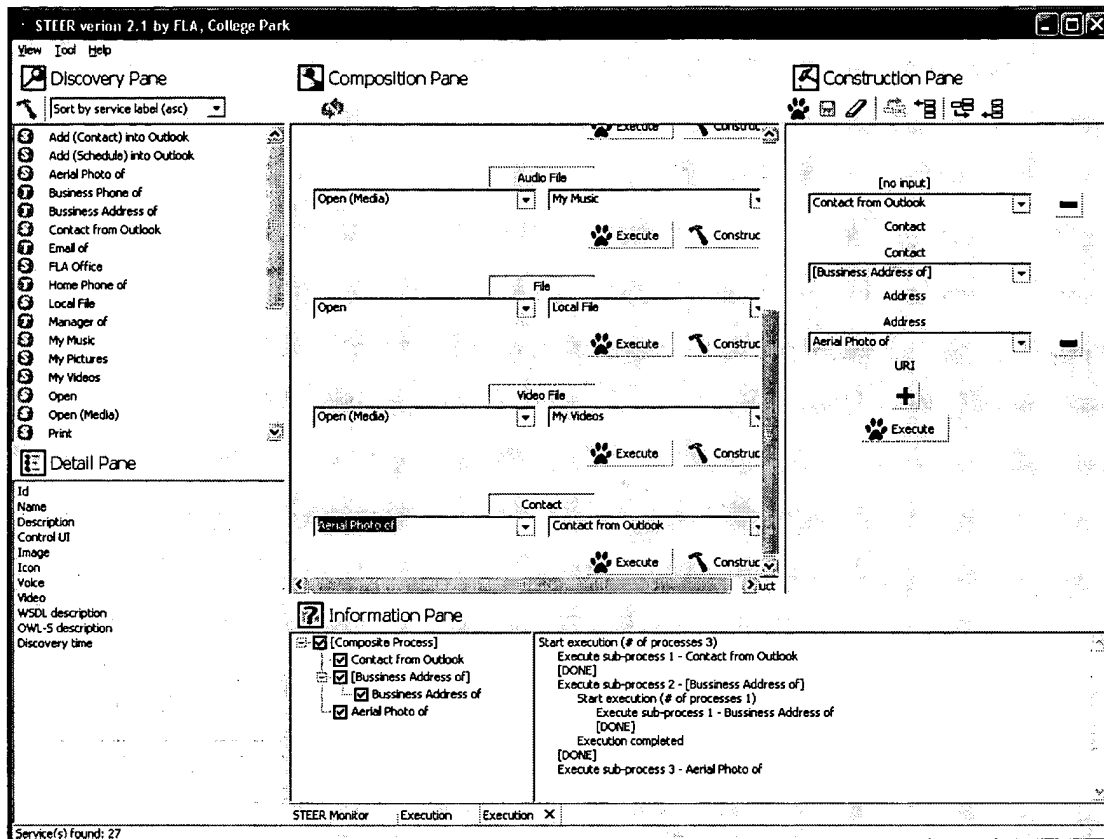


Figure 17 User Interface Full Version 1700

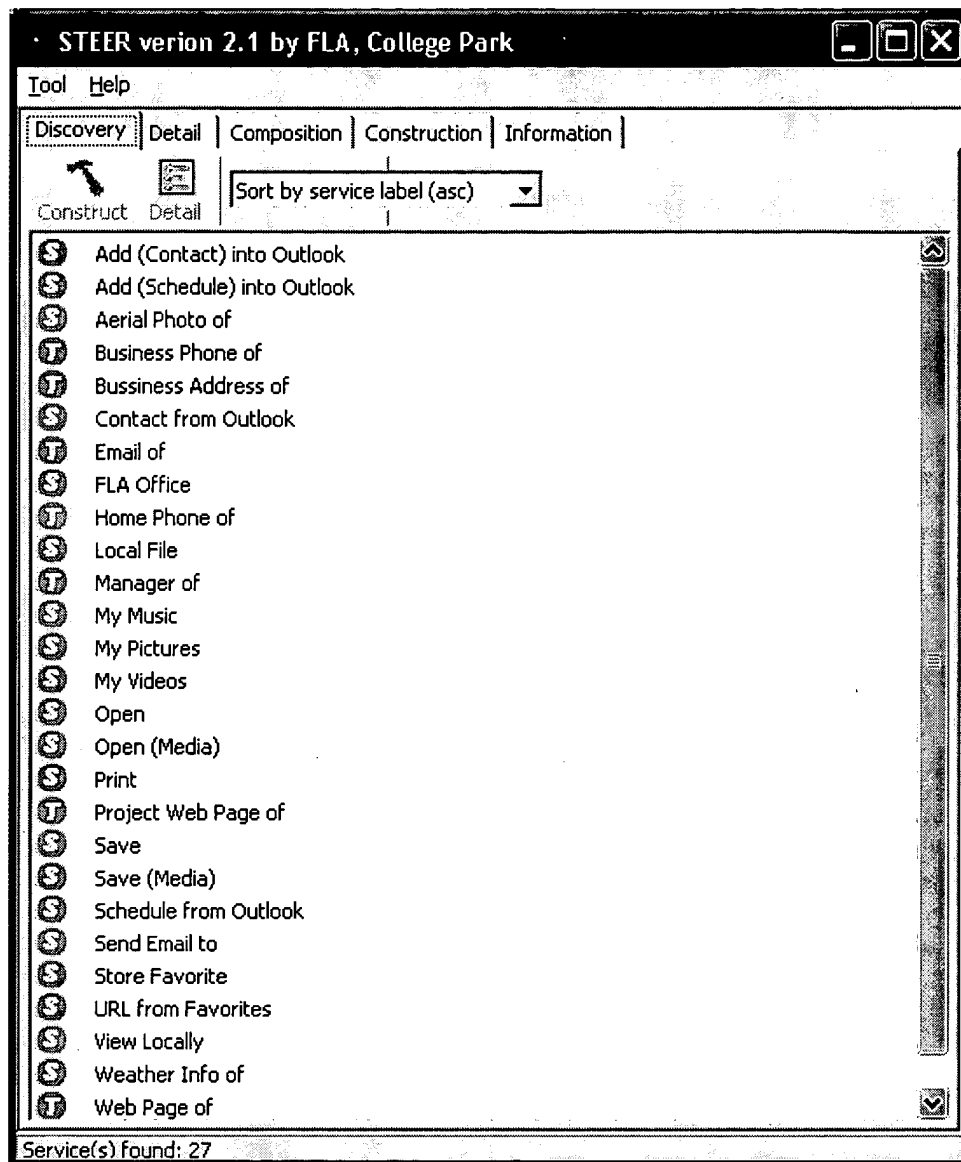


Figure 18 User Interface Tab Version (I) 1800

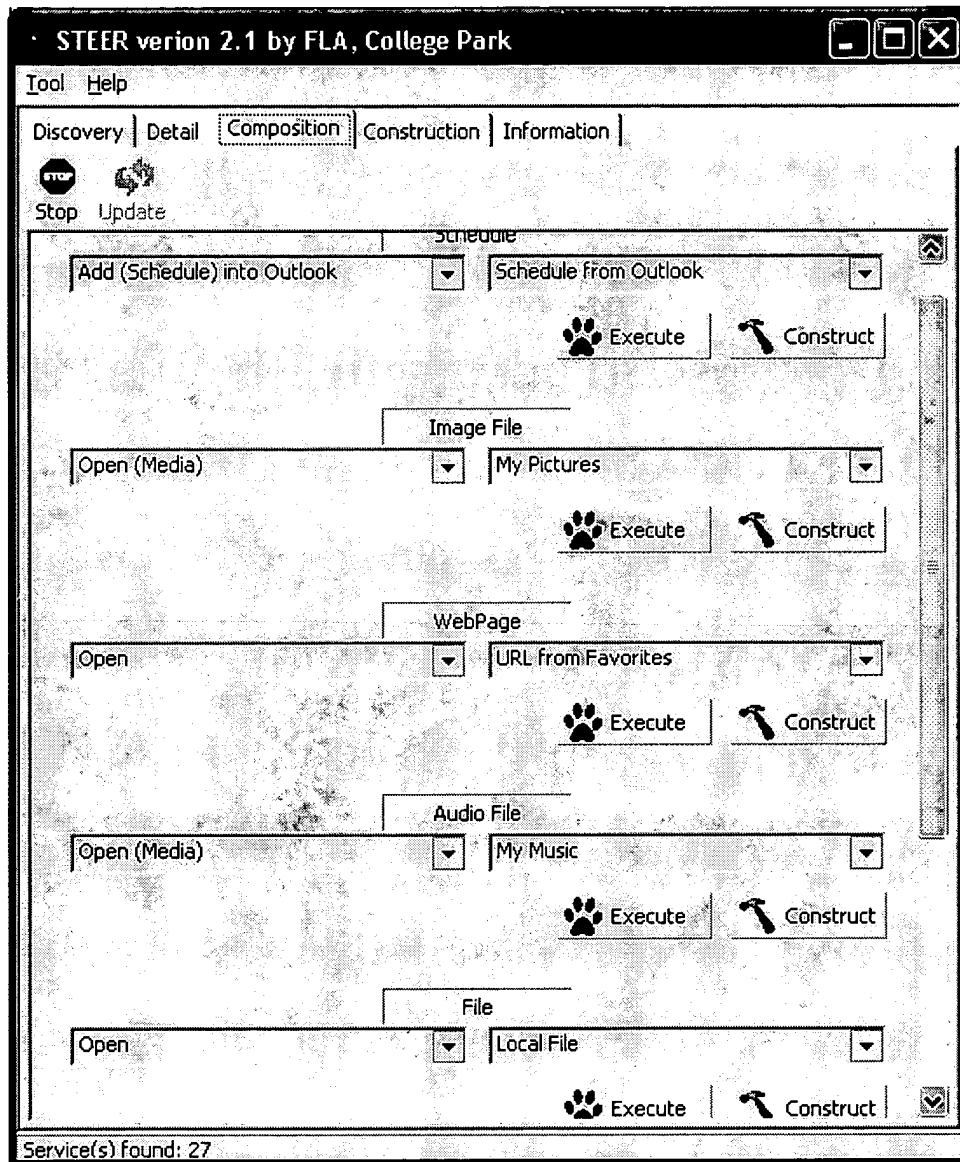


Figure 19 User Interface Tab Version (II) 1900

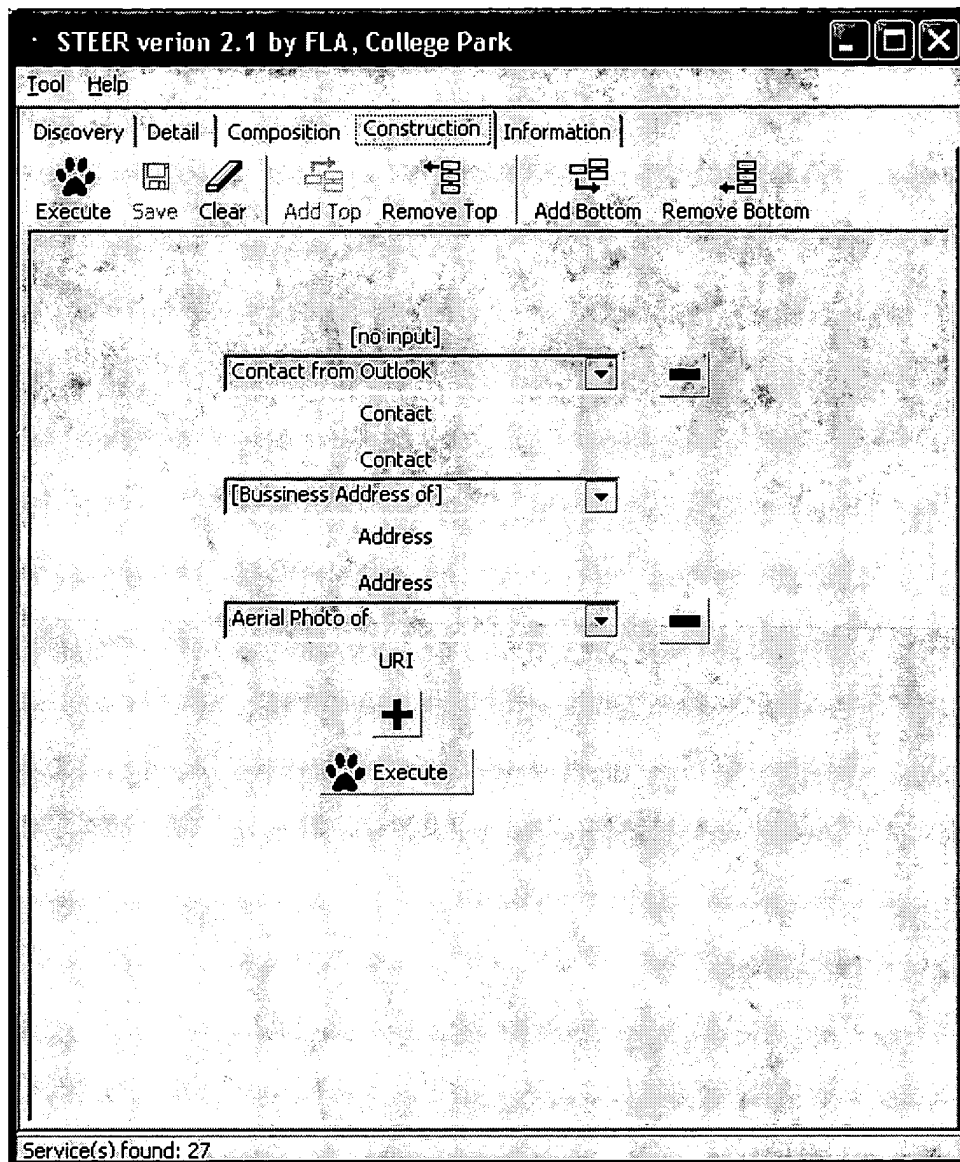


Figure 20 User Interface Tab Version (III) 2000

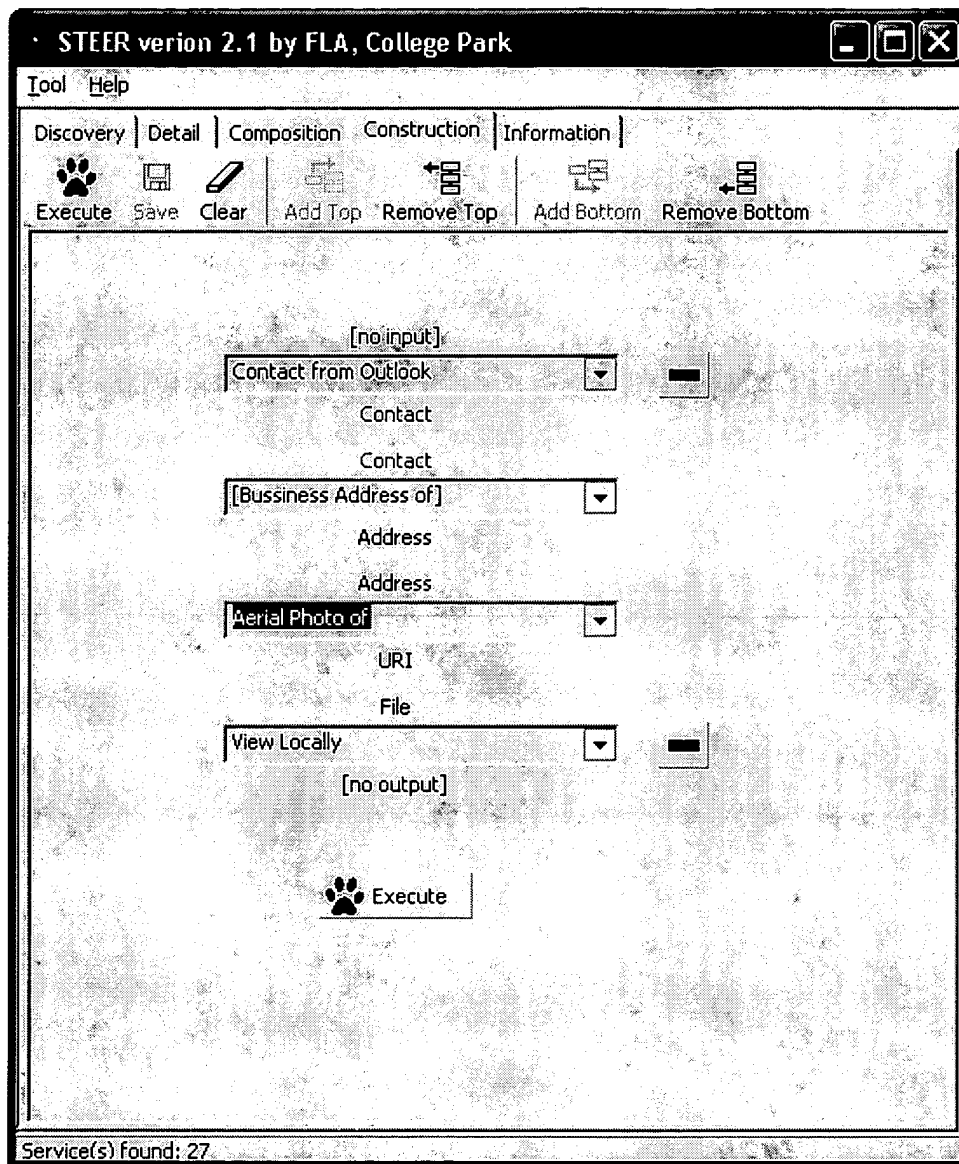


Figure 21 User Interface Tab Version (IV) 2100

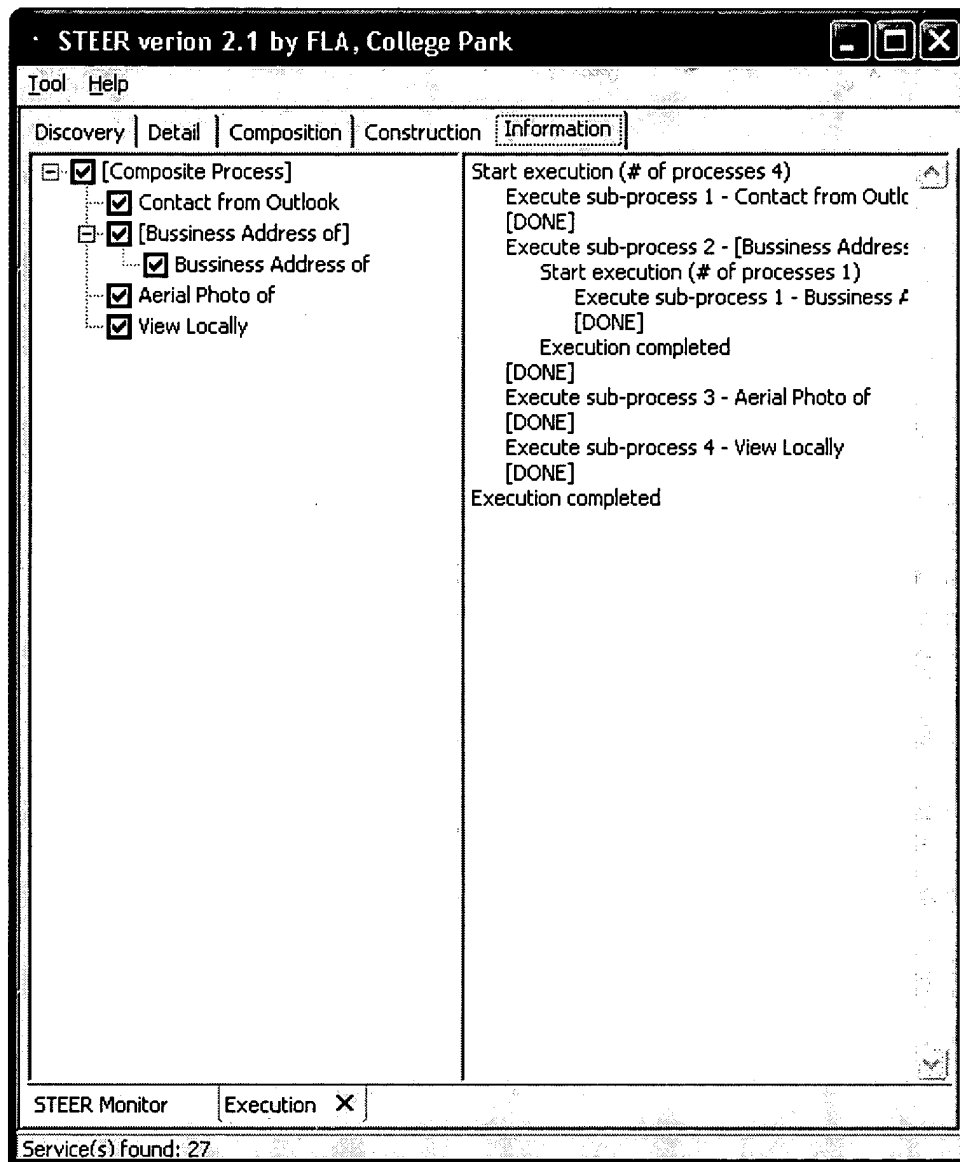


Figure 22 User Interface Tab Version (V) 2200

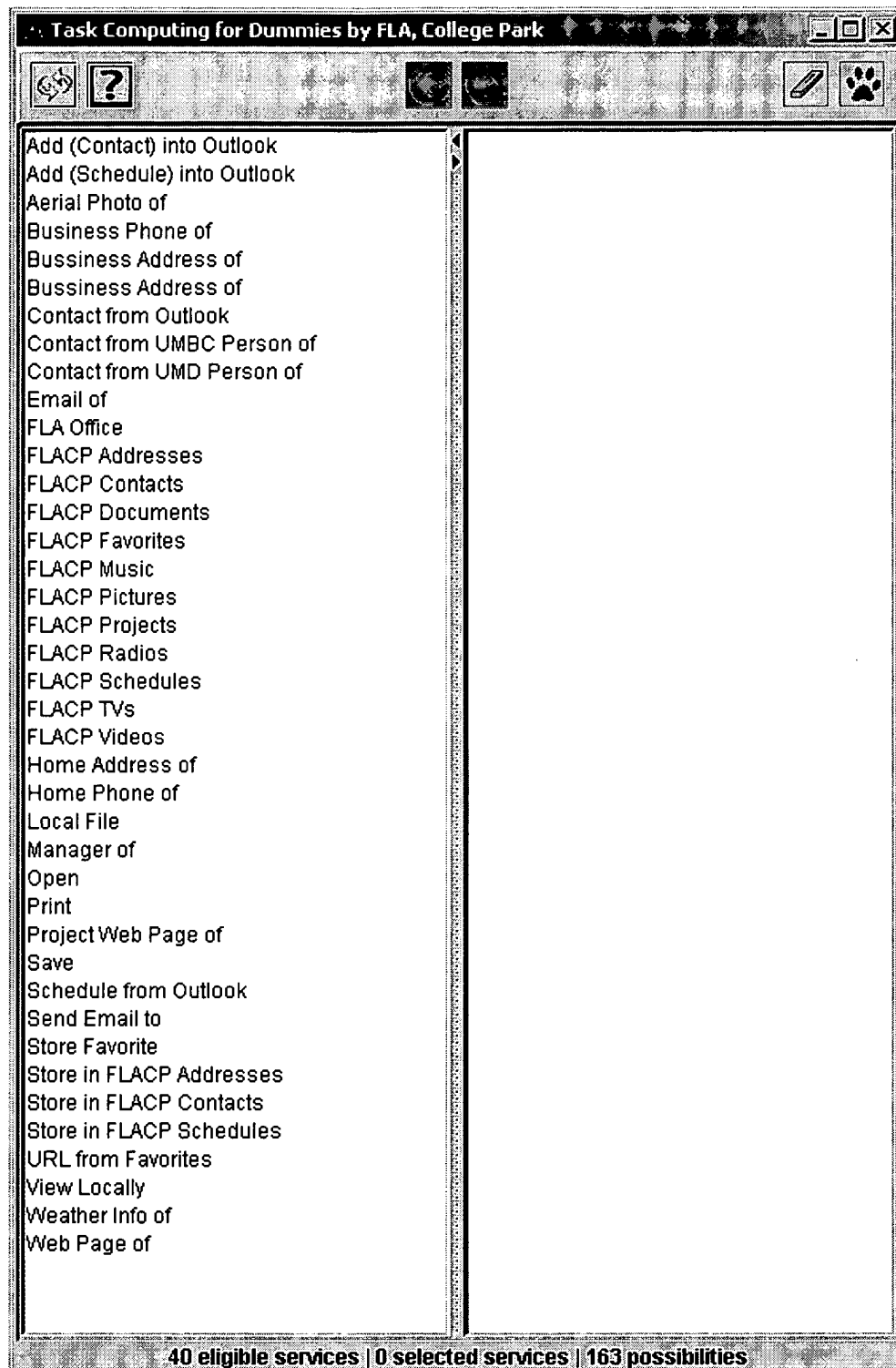
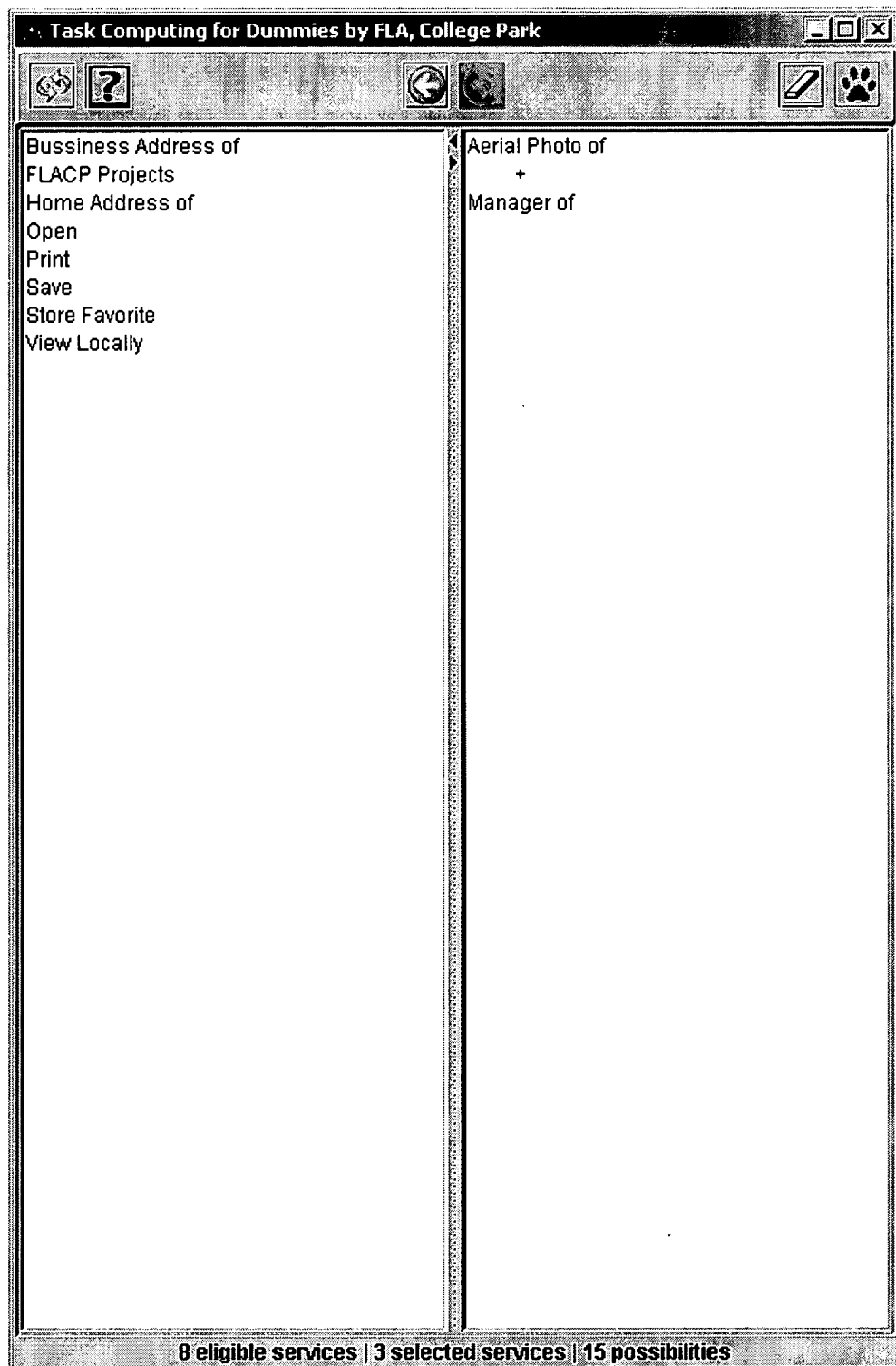


Figure 23 User Interface Flow Version (I) 2300



**Figure 24 User Interface Flow Version (II) 2400**



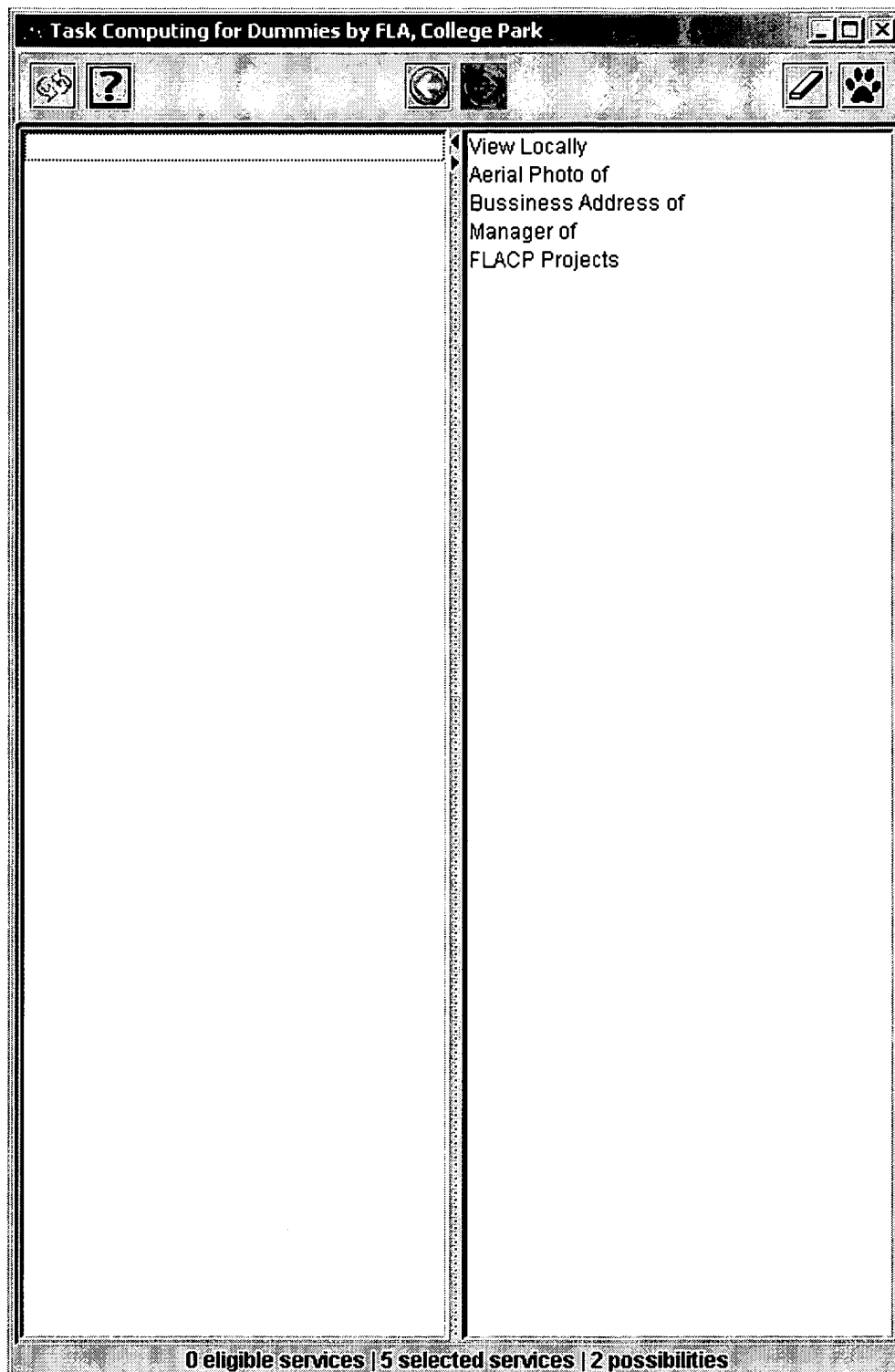
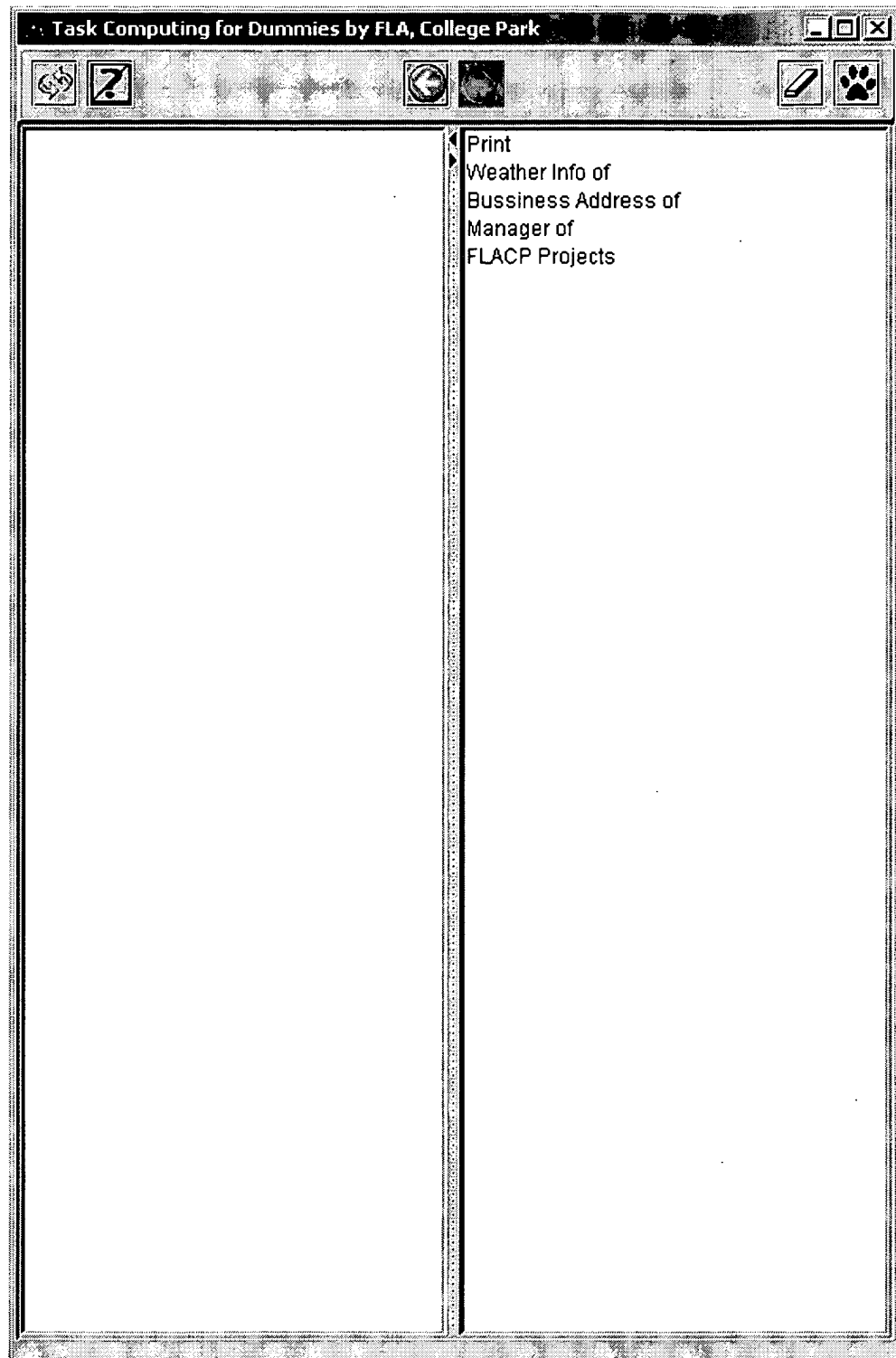


Figure 25 User Interface Flow Version (III) 2500



**Figure 26 User Interface Flow Version (IV) 2600**

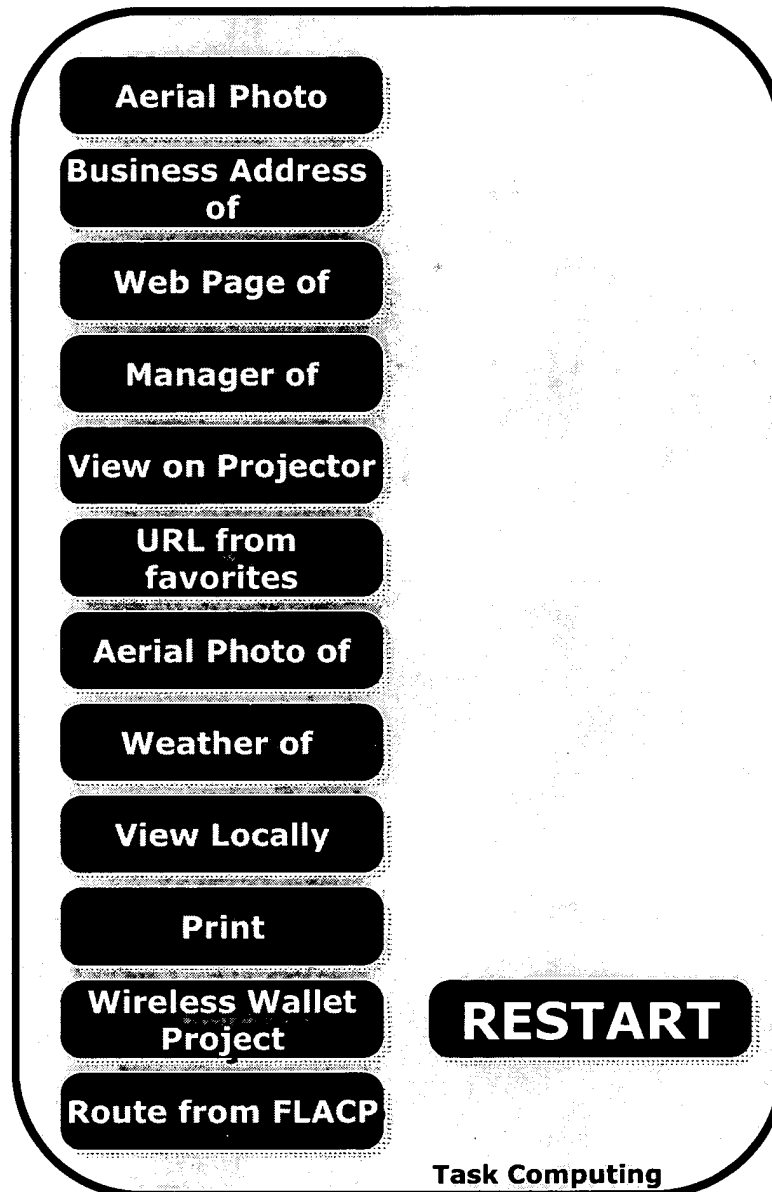


Figure 27 At the Start 2700



Figure 28 After User Selection 2800

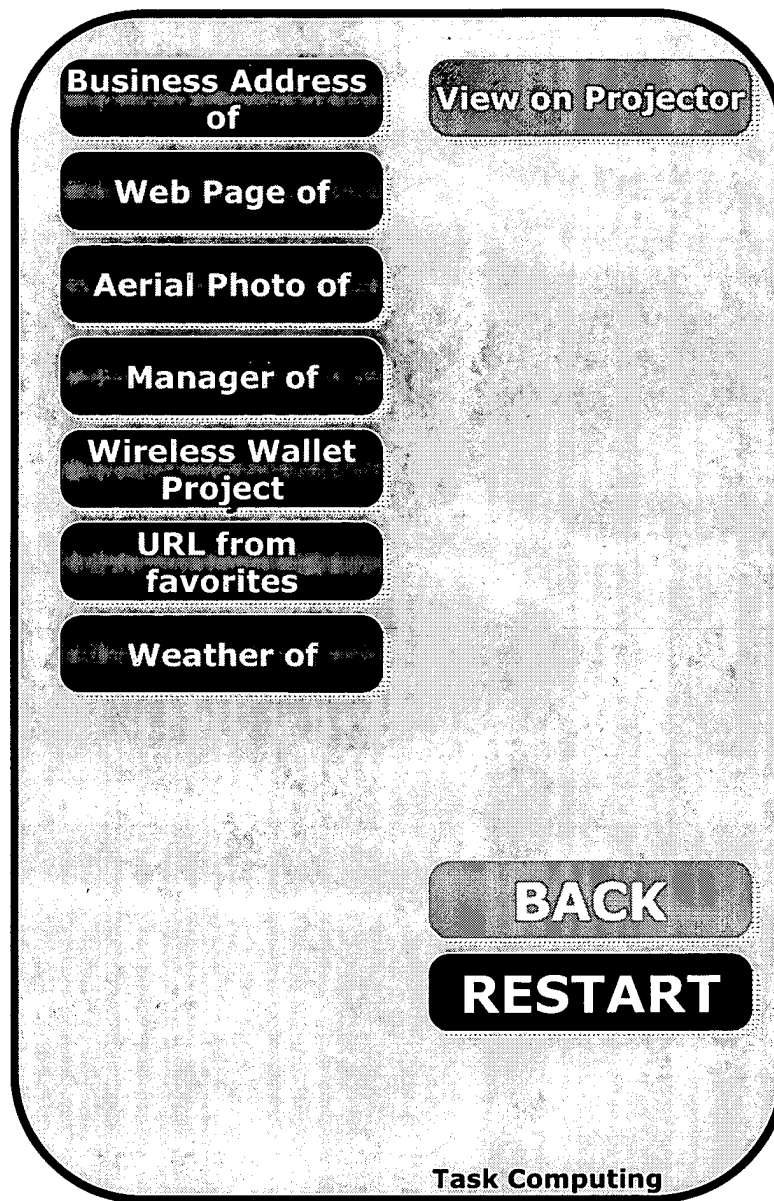


Figure 29 After Refreshing of Left Panel 2900

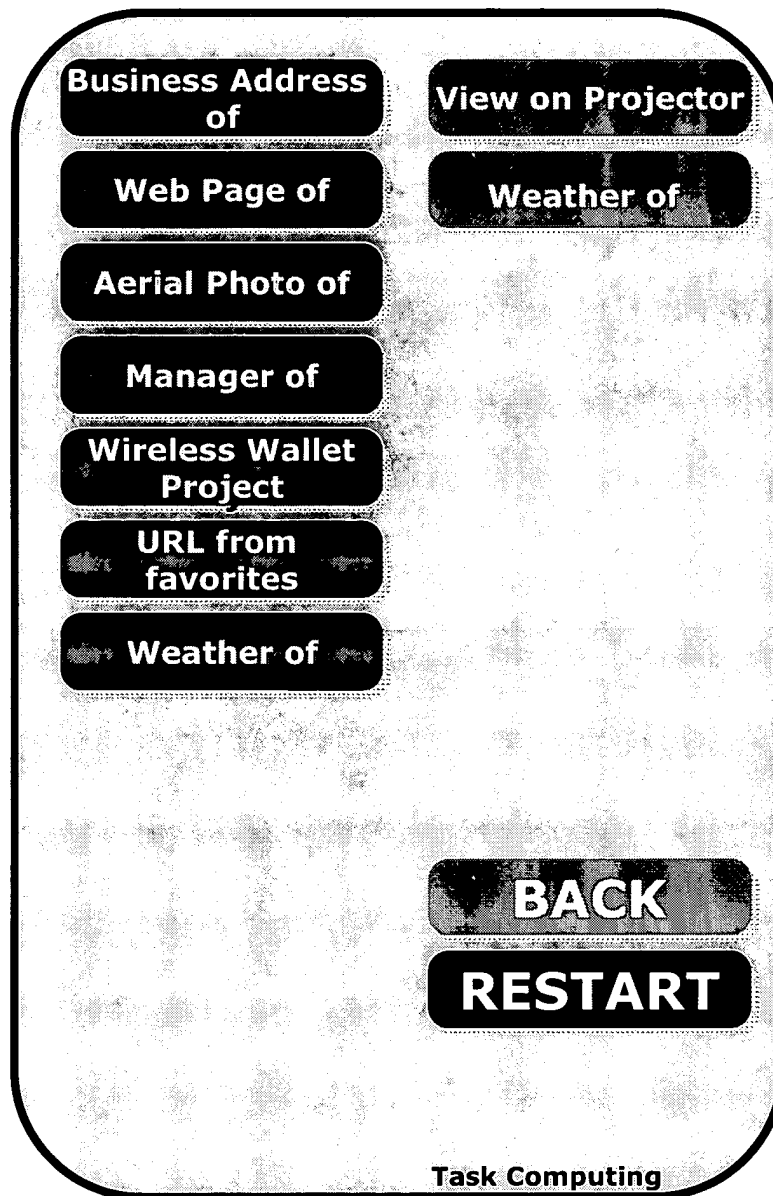


Figure 30 After User Selection 3000

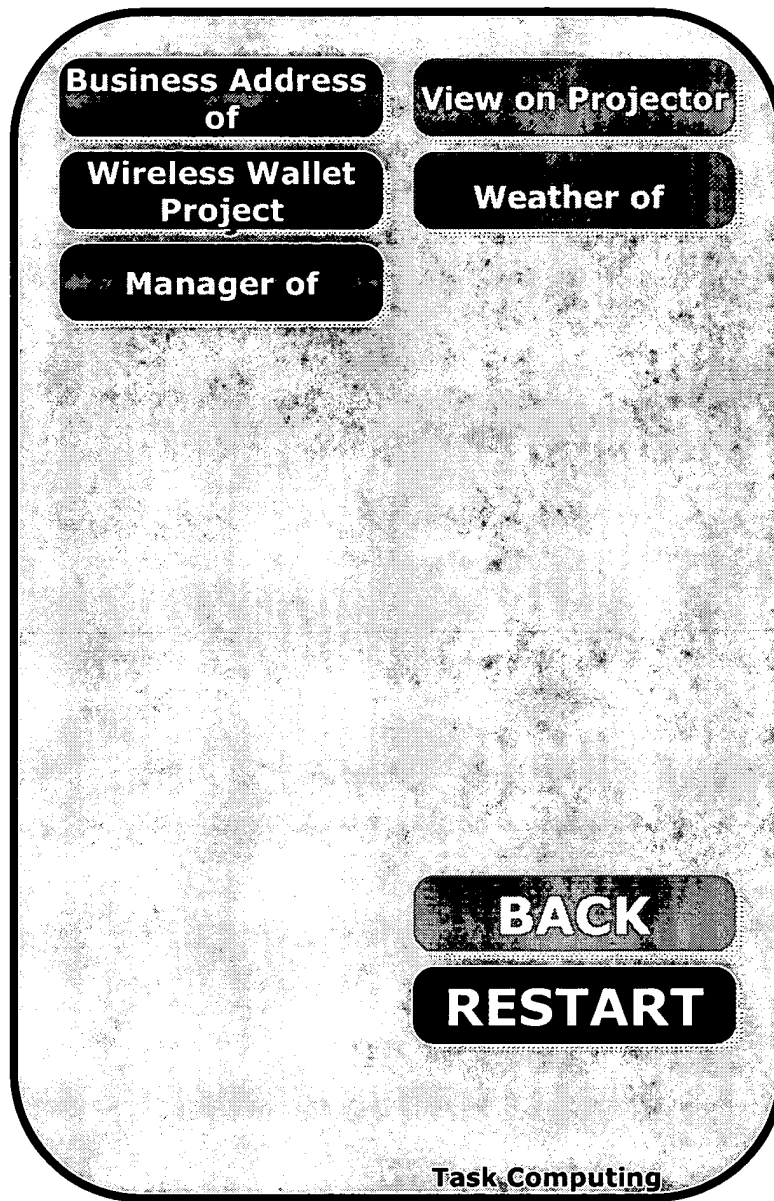


Figure 31 After Refreshing of Left Panel 3100

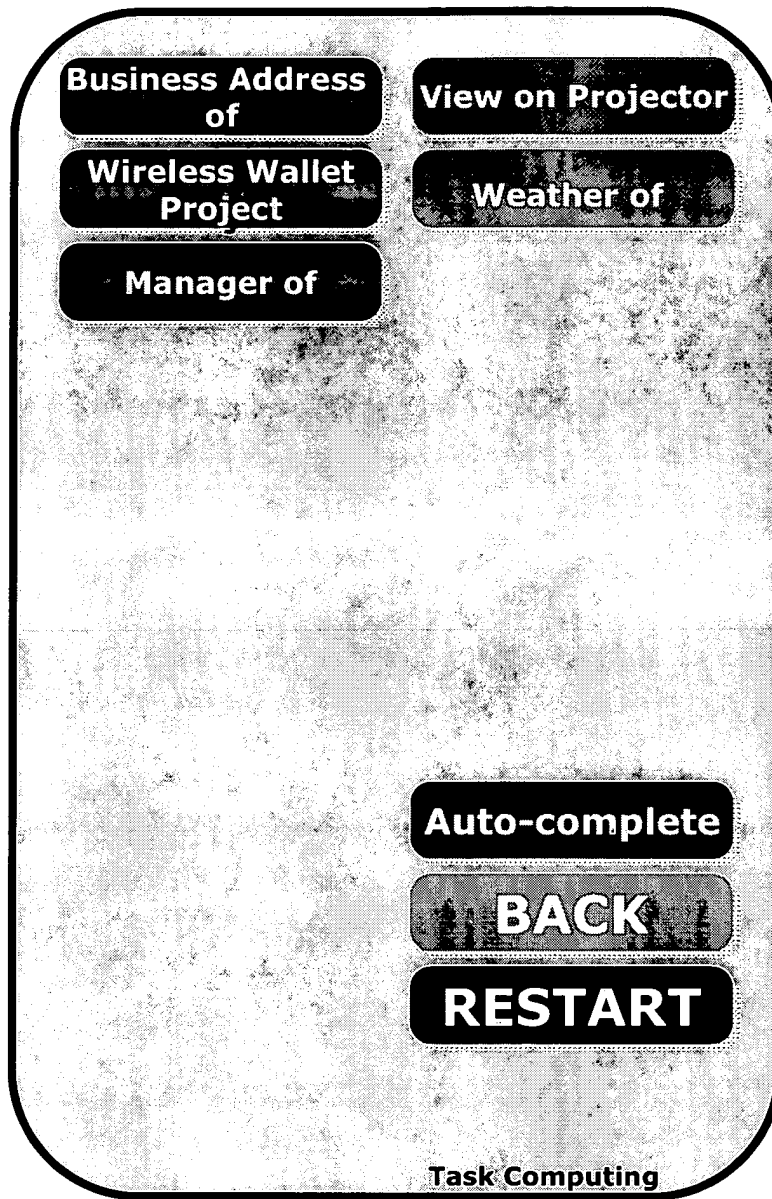


Figure 32 Auto-complete is Now Possible 3200



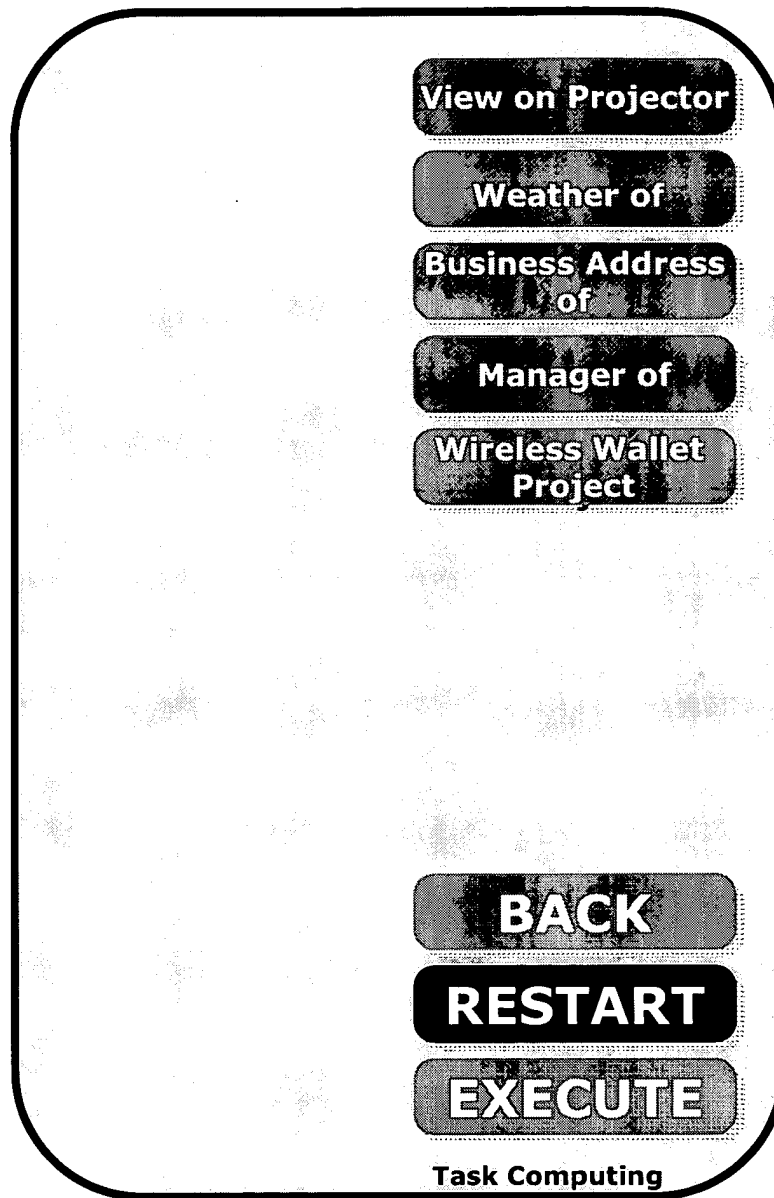


Figure 33 After User Selects Auto-complete; Alternatively if Auto Complete is Possibly, it Might be Done Automatically 3300

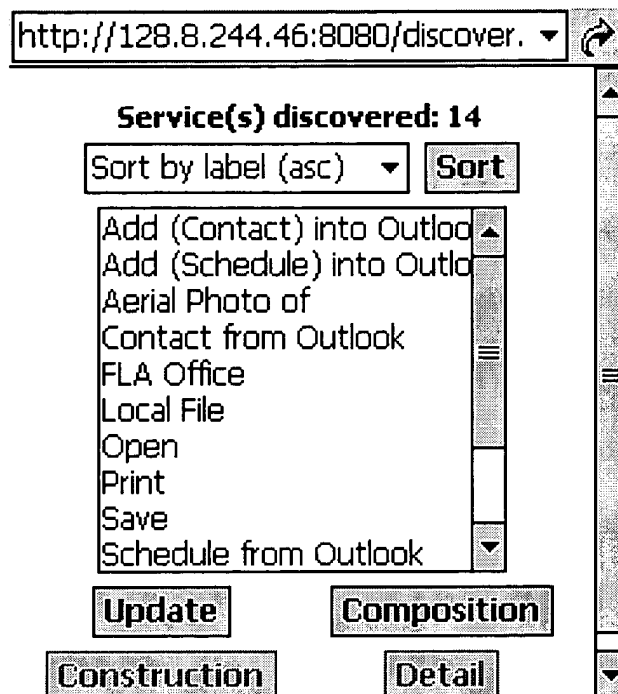


Figure 34 User Interface Web Version (I) 3400

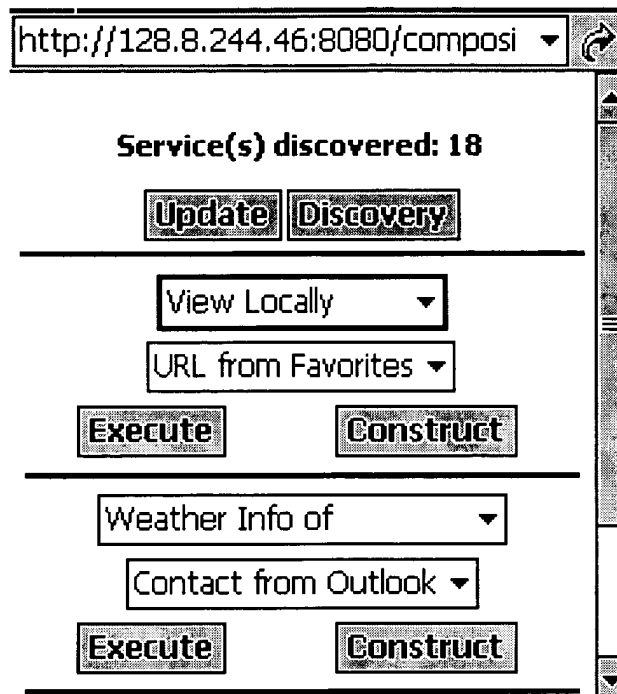



Figure 35 User Interface Web Version (II) 3500

http://128.8.244.46:8080/construc ▼ 

Execute

Save

Discovery

Composition

---

Add

Remove

---

Contact from Outlook ▼

Bussiness Address of ▼

---

Add

Remove

---

Figure 36 User Interface Web Version (III) 3600

http://128.8.244.46:8080/construc ▾

Execute

Save

Discovery

Composition

Add

Remove

Contact from Outlook ▾


Bussiness Address of ▾

Aerial Photo of ▾

Add

Remove

Figure 37 User Interface Web Version (IV) 3700

<http://128.8.244.46:8080/execute> ▼ 

**Composition**

**Discovery**

---

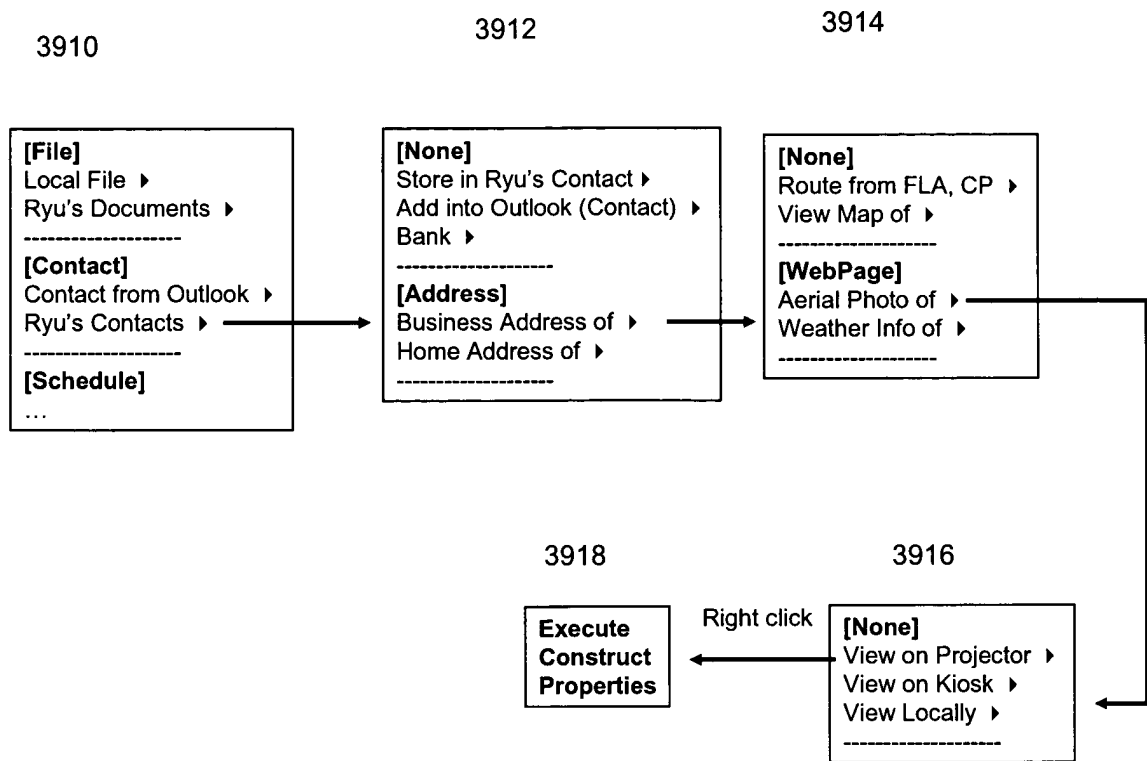
### **Execution List**

-> Contact from Outlook  
Business Address of  
Aerial Photo of  
Save

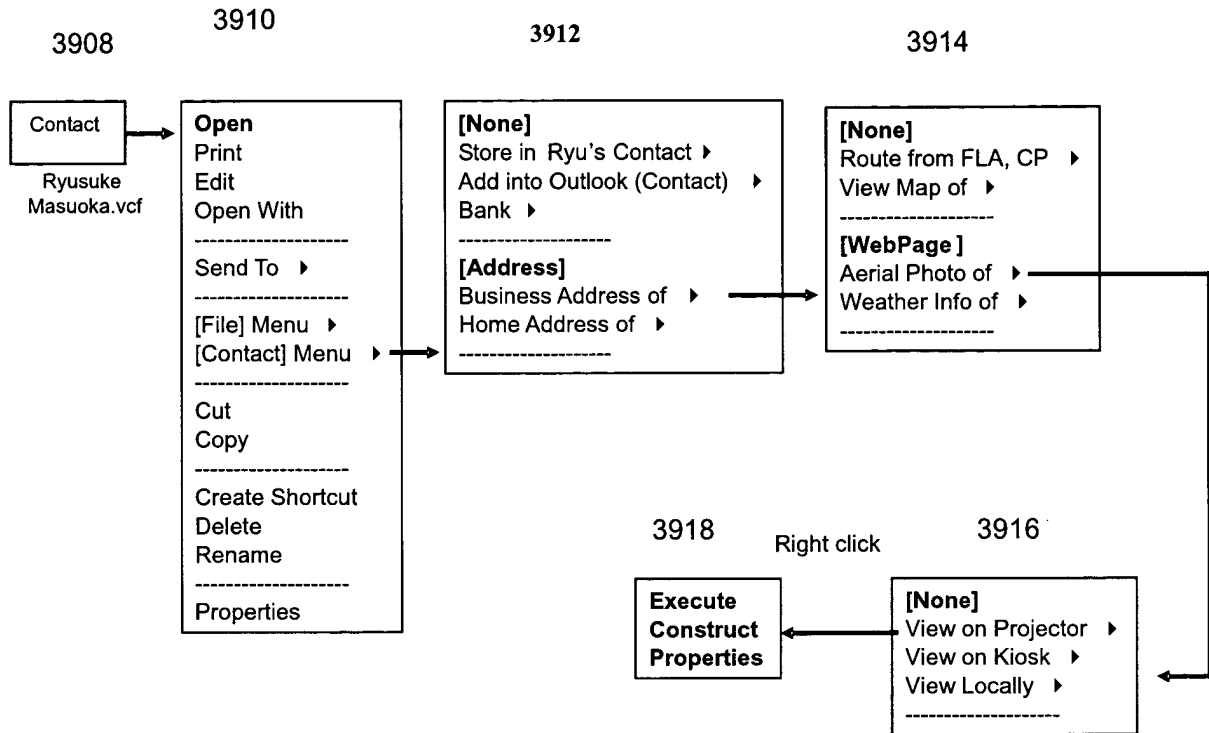
---

[View Execution Detail](#)

**Figure 38 User Interface Web Version (V) 3800**

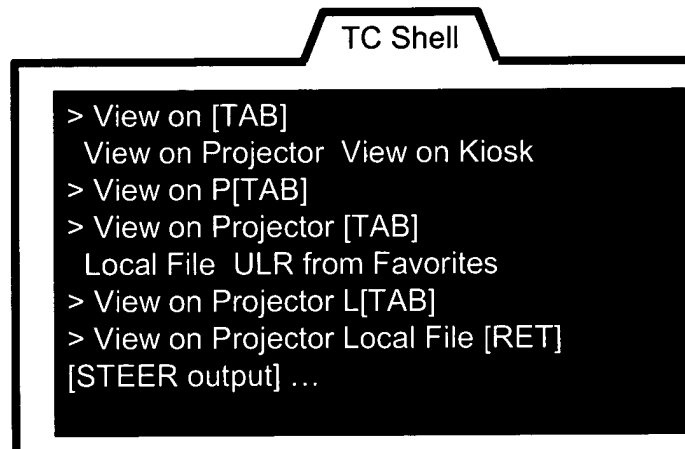


**Figure 39 User Interface Nested Menu Version (I) 3900**



**Figure 40 User Interface Nested Menu Version (II) 4000**





**Figure 41 User Interface Command Line Version 4100**

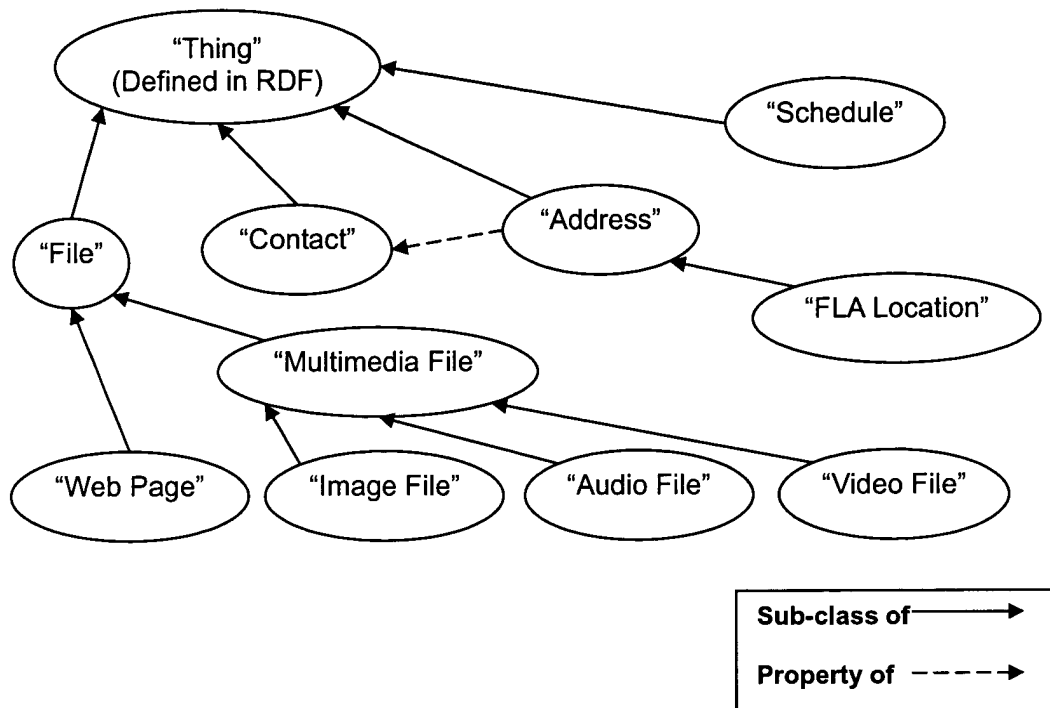
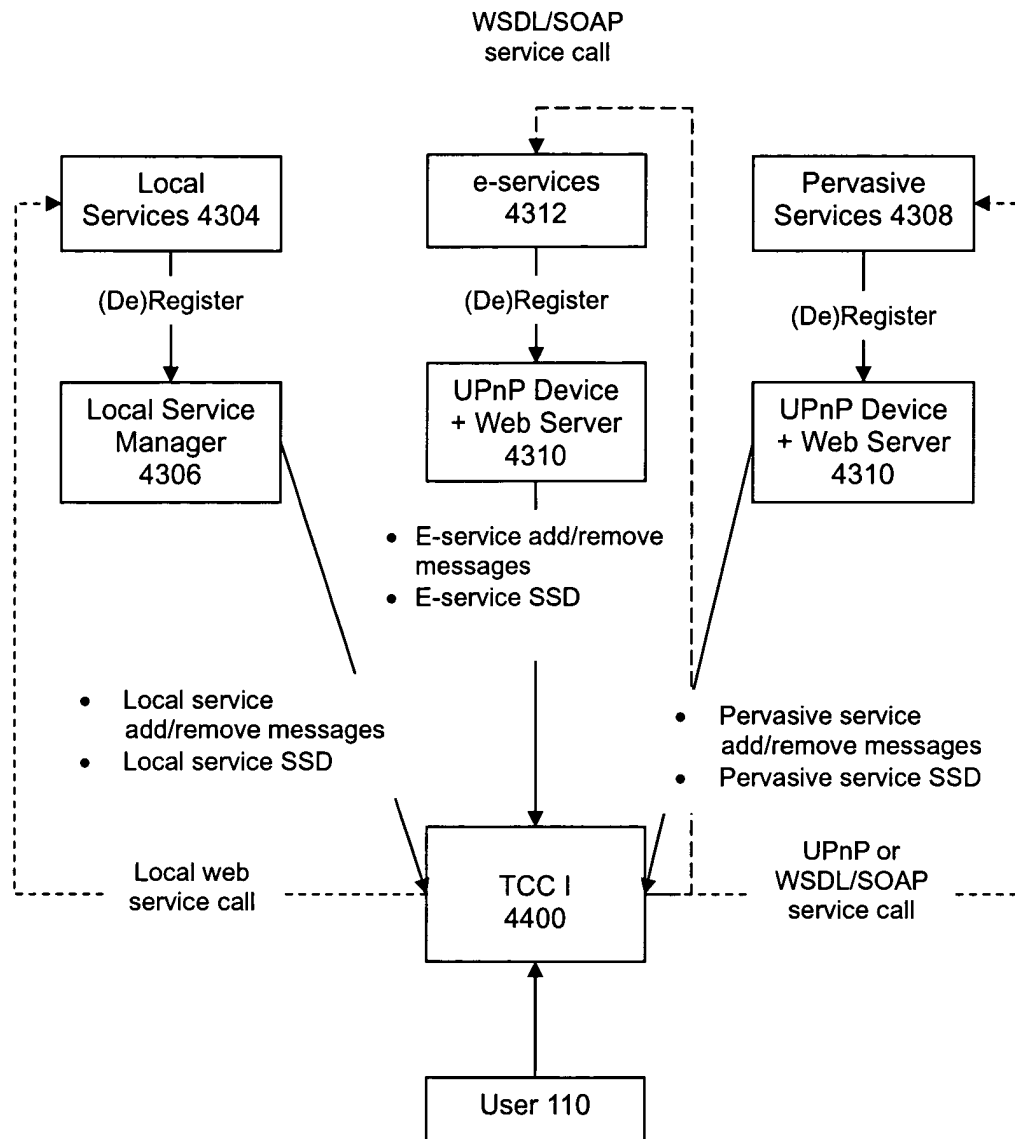


Figure 42 Relationship between Semantic Instance Types 4200



**Figure 43 TCE Embodiment Architecture 4300**

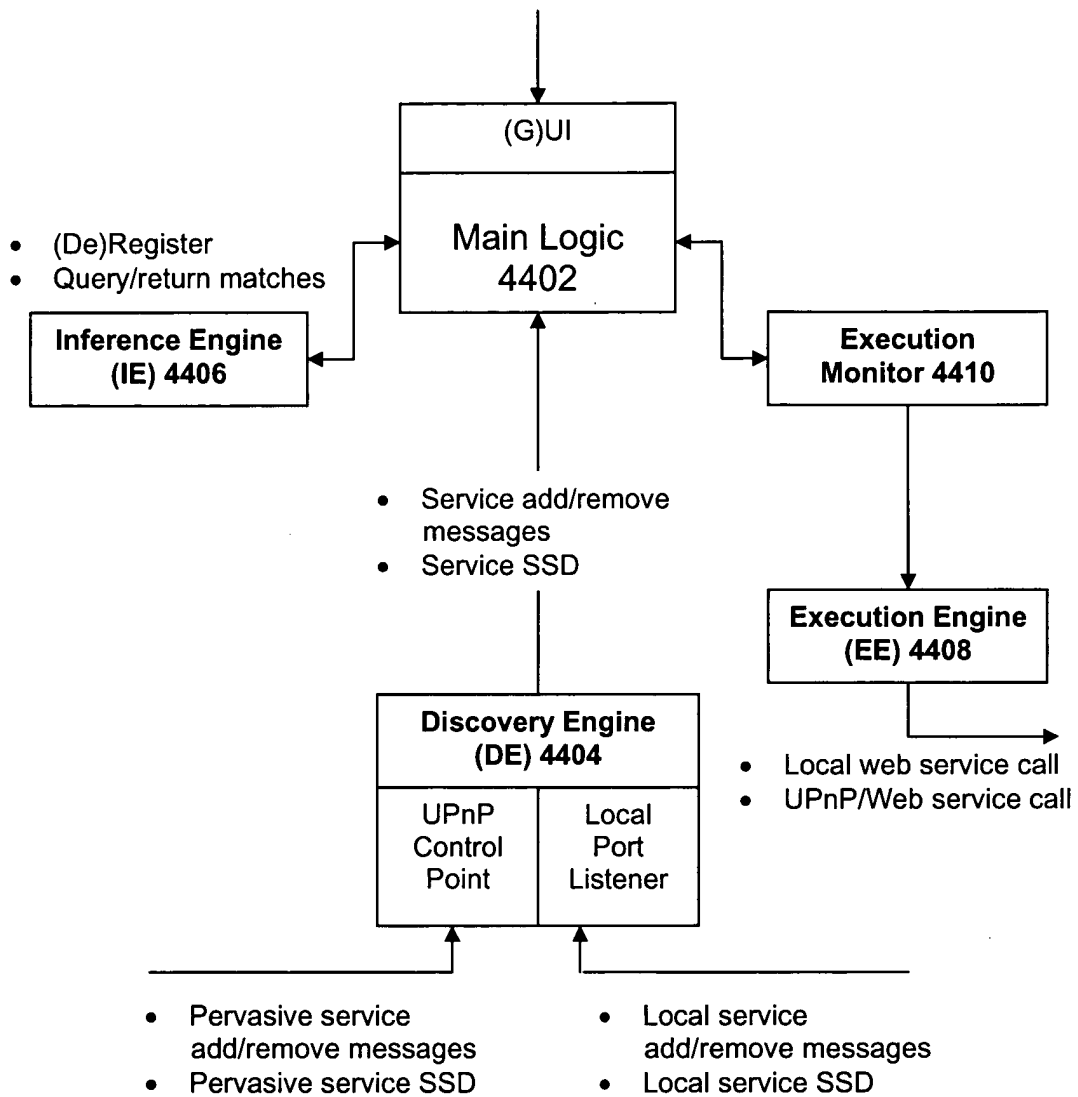


Figure 44 TCC I Internal Mechanism 4400

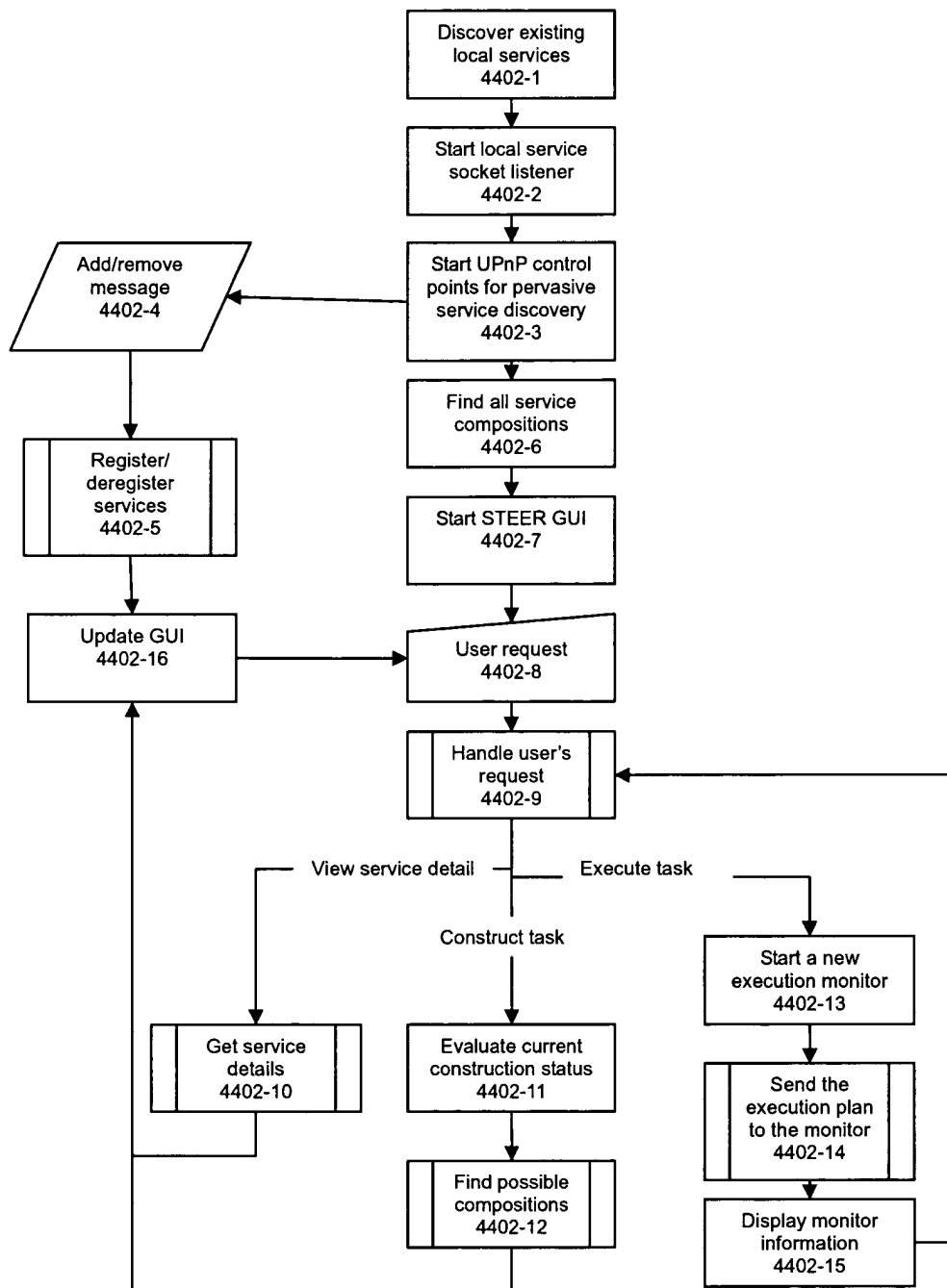
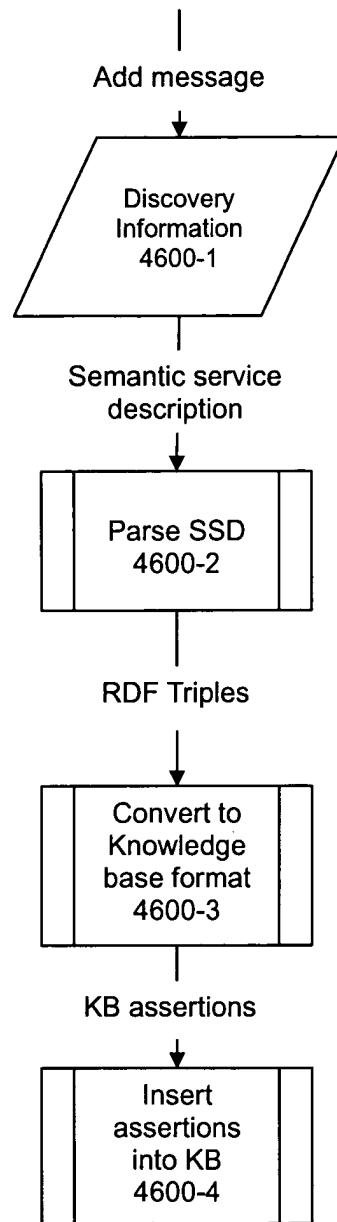




Figure 45 TCC I Main Logic 4402



**Figure 46 Discovery and Registration 4600 Using IE 4406**

Service Filter: - No Filter - 

---

**Local Services** 

- Insert Contact into Outlook
- Display Locally
- Insert Schedule into Outlook
- Local URL Provider Service
- Local Favorite URL Provider Service

**Pervasive Services**

- Contact: Yannis Labrou
- Courtyard Address
- Contact: Ryusuke Masuoka
- Dulles Airport Address
- L-Note Viewer
- LSM Location Provider
- BWI Airport Address**
- McDonalds Address

Figure 47Discovery Pane - 4700

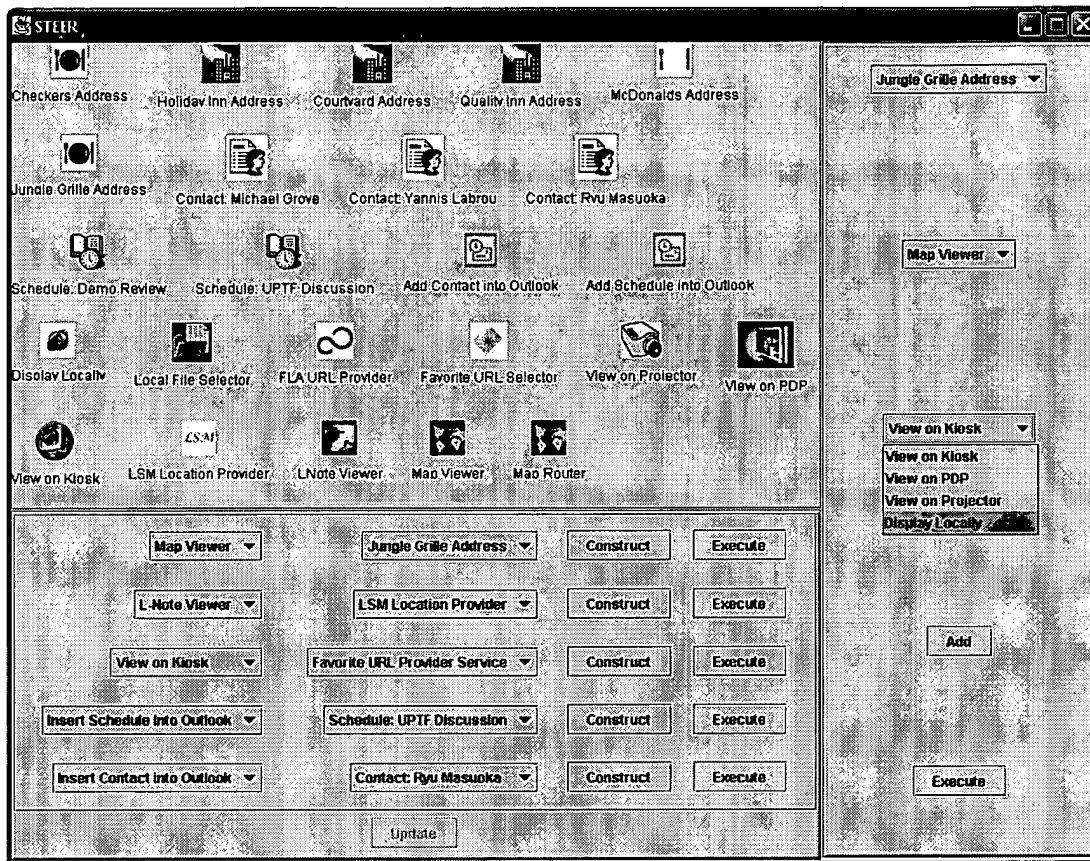


Figure 48 Discovery Pane with Icons for the Services 4800



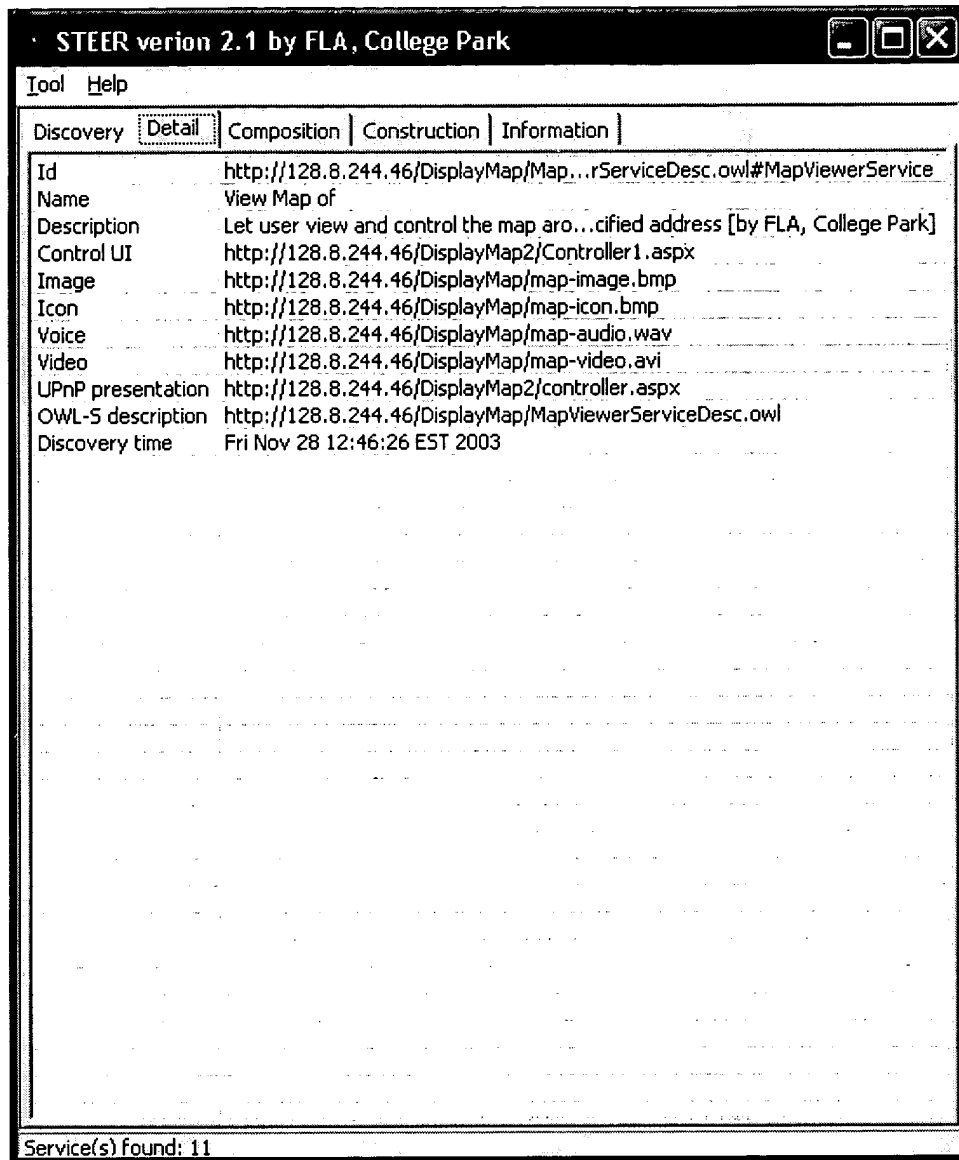


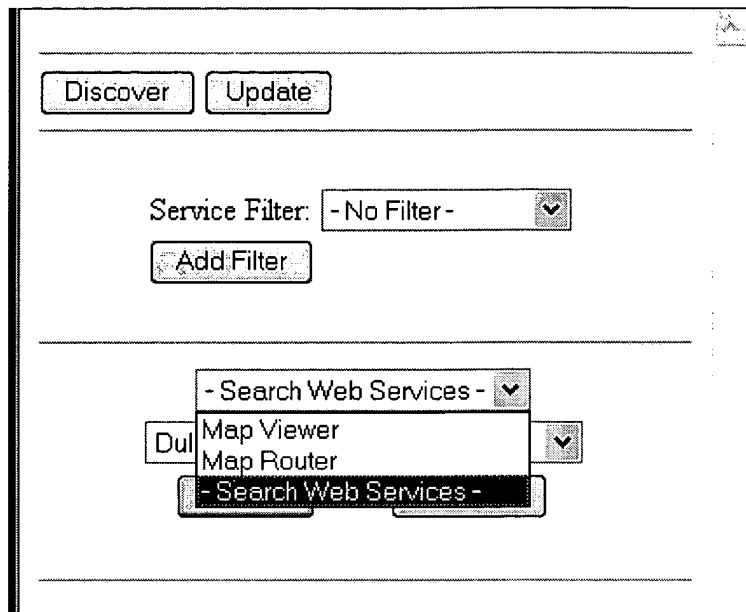
Figure 49 Detail Pane 4900

DiscoverUpdate

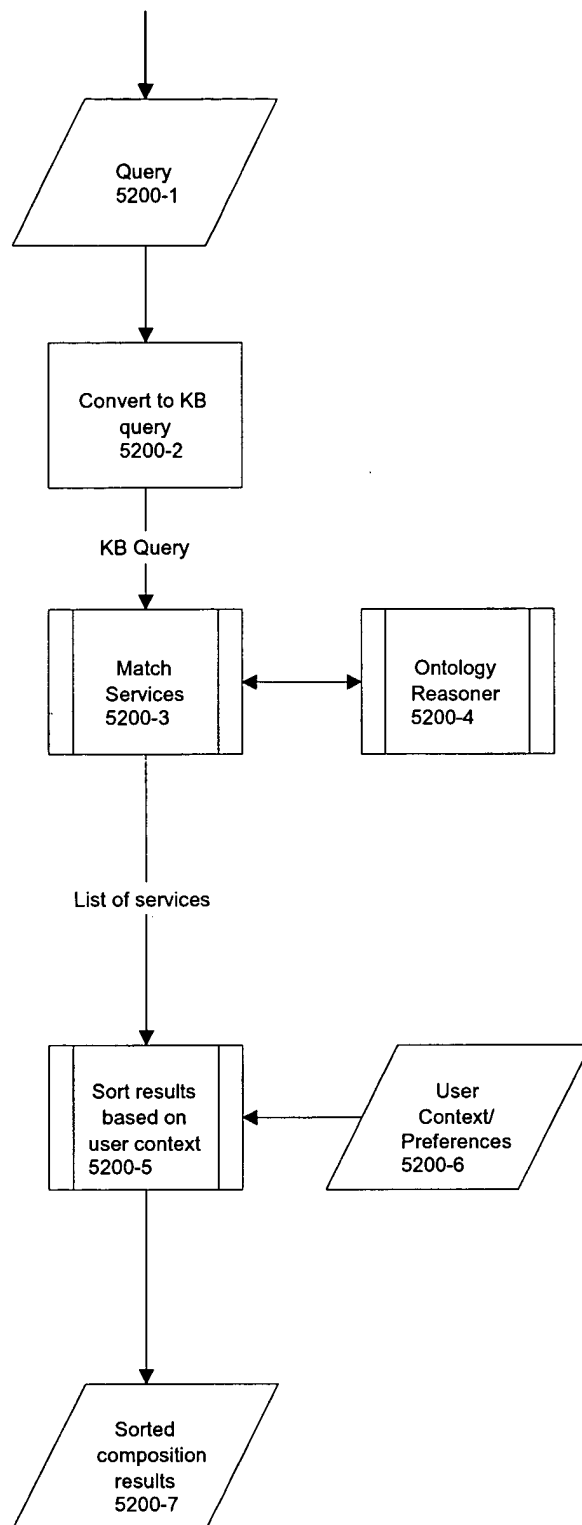
Service Filter: Filter by Location Room Current Location: Conference Room  
Add Filter

Map Viewer  
Dulles Airport Address  
ExecuteConstruct

Figure 50 Service Filtering 5000



**Figure 51 Discovery Pane shown with “Search Web Services” 5100**



**Figure 52 Find Compositions 5200 Using the IE 4406**

DiscoverUpdate

Service Filter: - No Filter -  
Add Filter

Map Viewer  
Dulles Airport Address  
ExecuteConstruct

Total:  
Fee: \$2.84  
Est. time: 00:39

L-Note Viewer  
LSM Location Provider  
ExecuteConstruct

Display Locally  
FLA URL Provider  
ExecuteConstruct

Insert Contact into Outlook  
Contact: Ryusuke Masuoka  
ExecuteConstruct

DiscoveryUpdate

Figure 53 Composition Pane 5300

Service Filter: - No Filter -

Add Filter

---

Add Service

[ - None - ]

FLA URL Provider Remove Service

[ - URL - ] Add Service

Display Locally Remove Service

[ - Control URL - ]

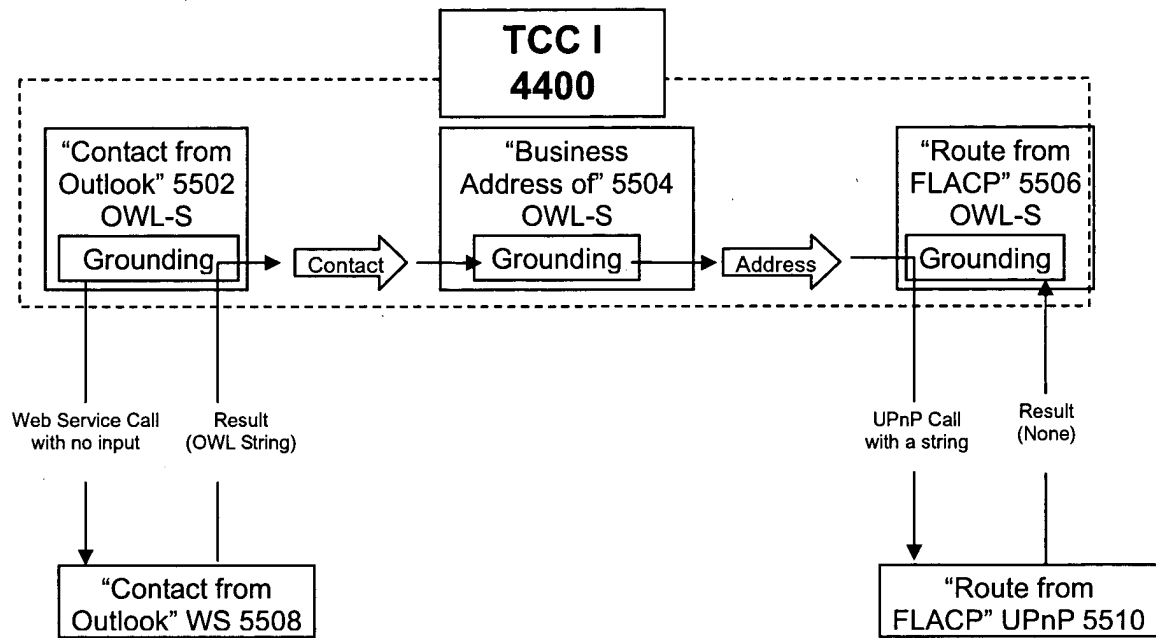
Add Service

Execute Save

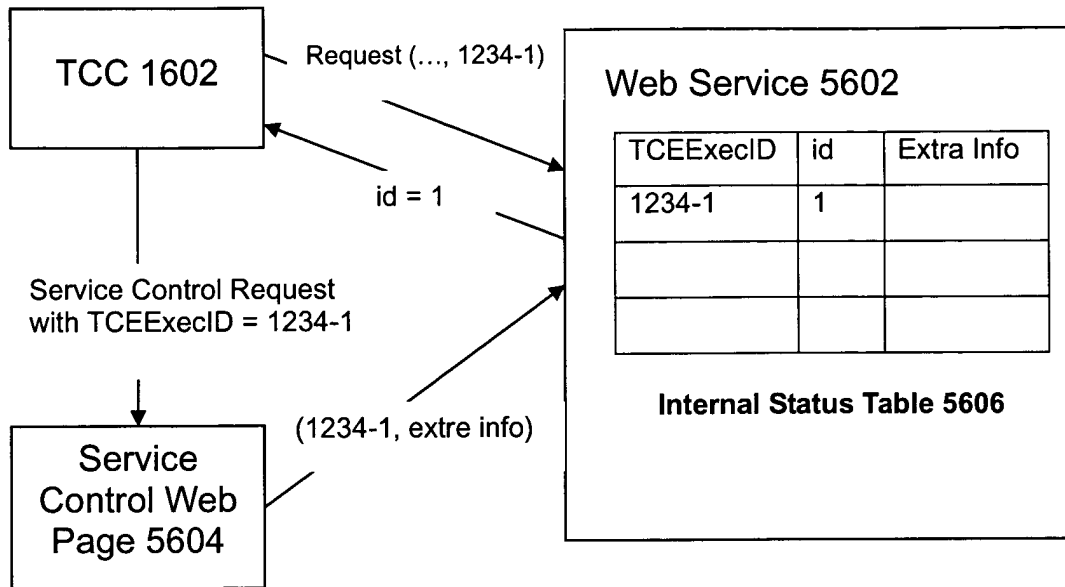
---

Discovery Compose

Figure 54 Construction Pane 5400



**Figure 55 Task Execution in Semantic Layer and Syntactic Layer 5500**



**Figure 56 Invocation of Web Service with Web Server Support 5600**



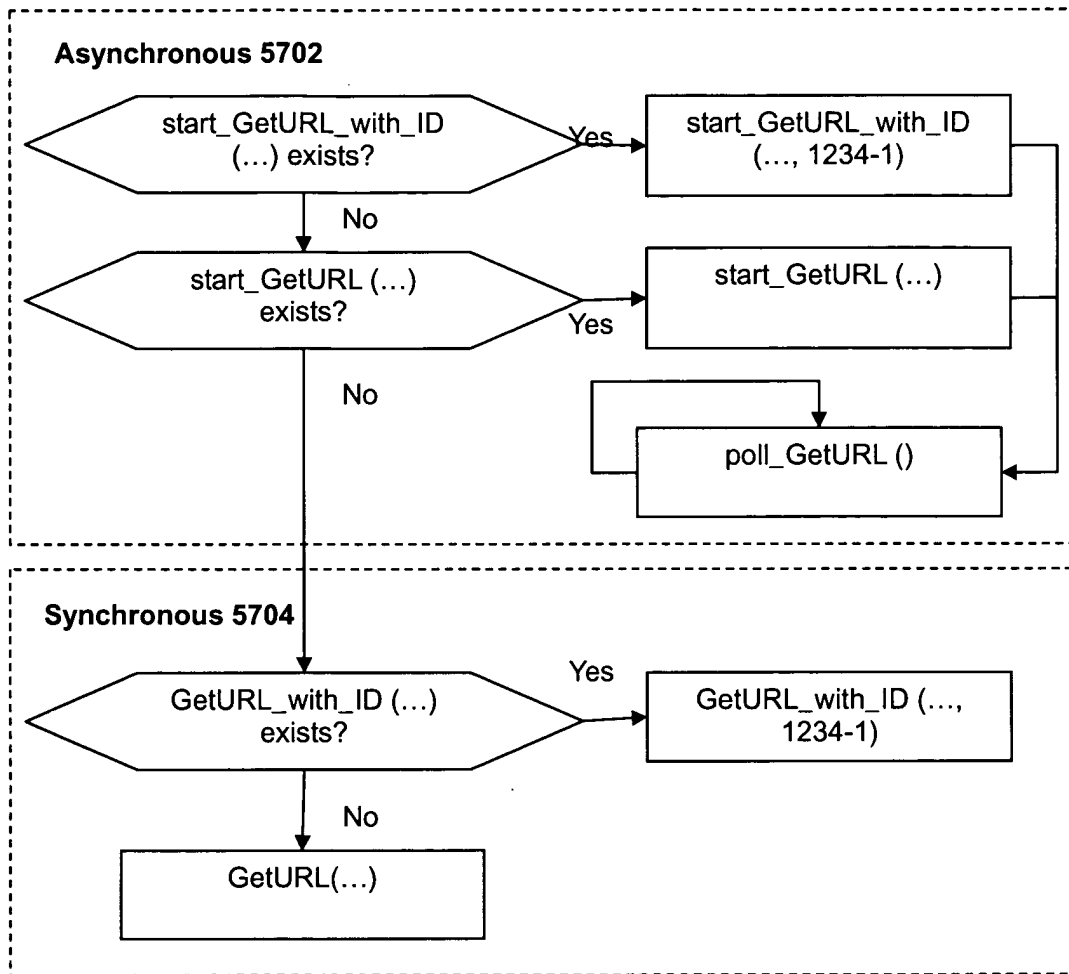



Figure 57 Service Invocation Flowchart 5700 of TCC I 4400

<http://128.8.244.46:8080/execute> ▼ 

**Composition** **Discovery**

---

### Execution List

-> Jeff's File

View on Browser

---

View Execution Detail

**Figure 58 Web-based UI with Service Control UI (I) 5800**

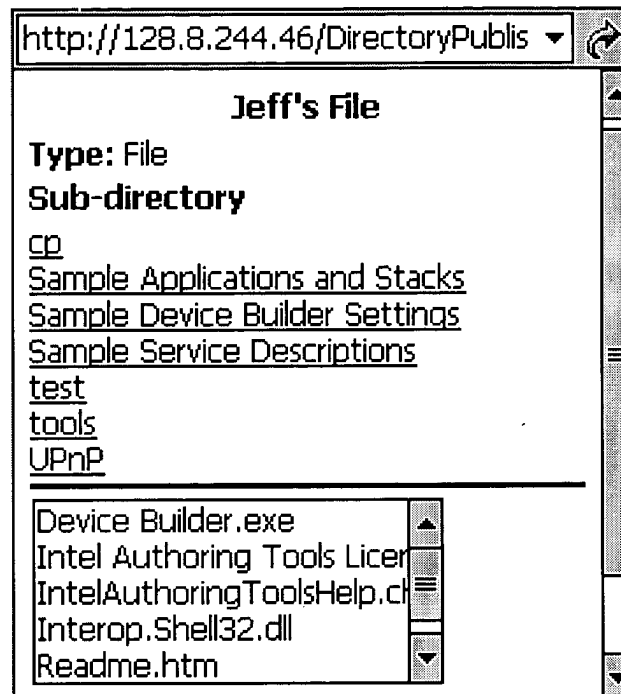


Figure 59 Web-based UI with Service Control UI (II) **5900**

http://128.8.244.46:8080/execute ▾ 

Composition

Discovery

---

### Execution List

Done Jeff's File

Done [View on Browser](#)

[View Execution Detail](#)

**Figure 60 Web-based UI with Service Control UI (III) 6000**

Done Executing:

User Input: Enter Book Title

Currently Executing: Amazon Book Search

Still to Execute:

Verify Credit Card  
Confirm Order  
Complete Order

UpdateSave

ReconstructDiscoveryCompose

Figure 61 Monitor Pane 6100

Inputs:

- None -

Add Service

[ - None - ]

Local File Selector      Exact Match: ☒

[ - Local File (File) - ]      Add Service

View On Projector      Exact Match: ☐      Min Resolution: 1024 x 768

Max Resolution:      x      Brand: - Any -

[ - Control URL (URL) - ]      Add Service

Display Locally      Exact Match: ☒

[ - None - ]

Add Service

Outputs:

- None -

Name: Present slides

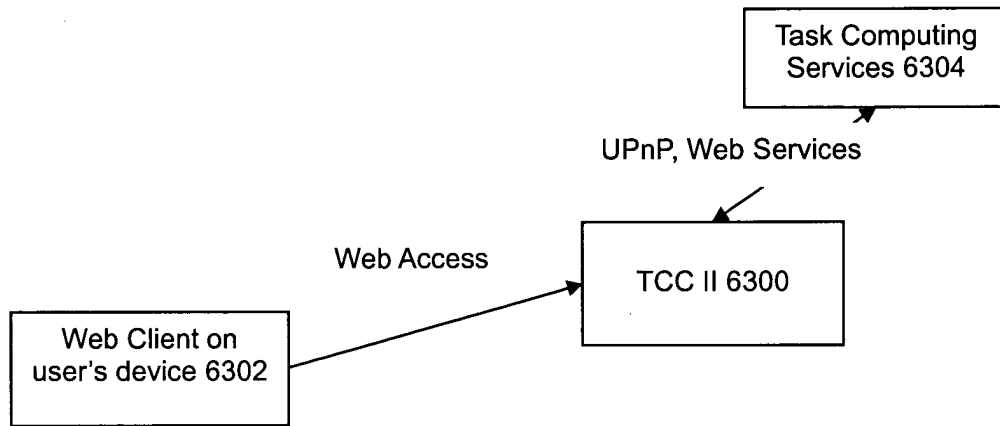
Text Description:

Present the PowerPoint slides on the projector available in the room.

Save      Cancel

Discovery      Compose

Figure 62 Save Pane 6200



**Figure 63 TCC II 6300**

```

...
<!-- Profile description -->

<profile:ServiceProfile rdf:ID="ProjectorProfile">
  <service:isPresentedBy rdf:resource="#ProjectorService"/>

  <profile:serviceName encoding="en">
    View on Projector</profile:serviceName>
  <profile:serviceName encoding="jp">
    プロジェクタで表示する</profile:serviceName>

  <profile:textDescription encoding="en">
    Lets you view the specified URL on the Projector
    in the conference room</profile:textDescription>
  <profile:textDescription encoding="jp">
    会議室のプロジェクタで指定された URL を表示し、
    コントロールする
  </profile:textDescription>

...


```

**Figure 64 Multiple Natural Language Support in SSD 6400**




## FLA Bank Service

### For Deposit

File Type:  

Target URL:

Service Name:

Time Out:   

### Current Available Services

Actions	File Type	Service Name	Original URL	Deposit Time	Time out	Unit
<input type="checkbox"/> M <input type="checkbox"/> D	File	Photo (Mexico Trip)	http://128.8.244.13/P237.jpg	12/13/2002 6:29:23 PM	10	Day (s)
<input type="checkbox"/> M <input type="checkbox"/> D	Favorite	Yahoo Home	http://www.yahoo.com	12/13/2002 6:29:41 PM	365	Day (s)
<input type="checkbox"/> M <input type="checkbox"/> D	Contact	Contact for Sam Chen	http://128.8.244.37/Sam.daml	12/13/2002 6:30:05 PM	30	Day (s)
<input type="checkbox"/> M <input type="checkbox"/> D	Schedule	Office Admin Meeting (12/17/02)	http://128.8.244.33/OAM.daml	12/13/2002 6:31:25 PM	5	Day (s)

Figure 65 Bank Service 6500

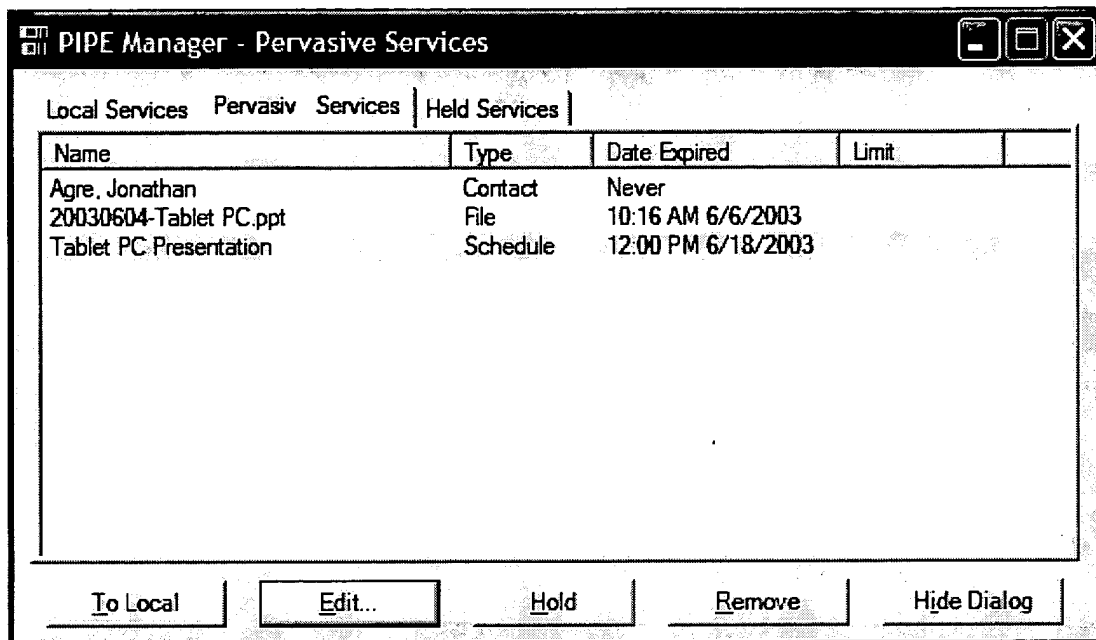
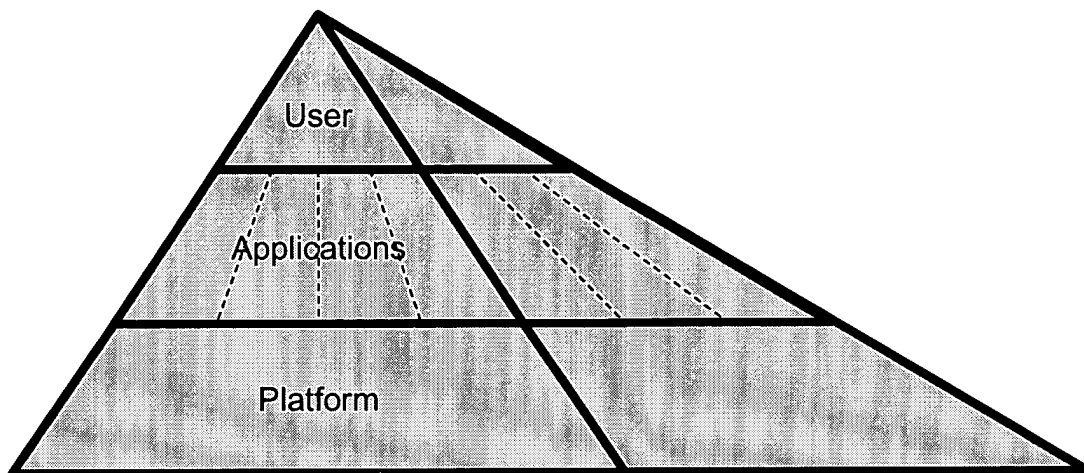


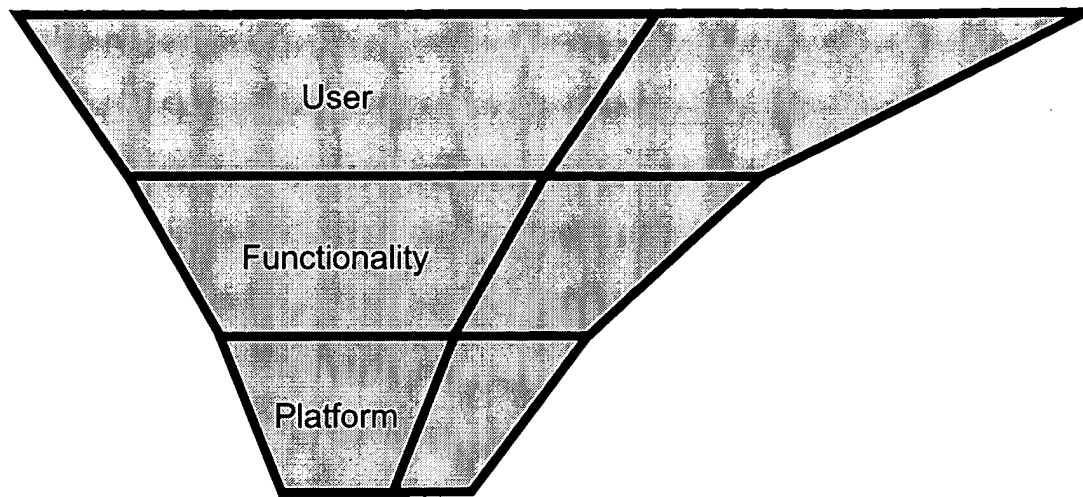
Figure 66 PIPE Manager 6600



**Figure 67 White Hole Drag & Drop Interface 6700**



**Figure 68 Capability Pyramid before Task Computing 6800**



**Figure 69 Inversed Capability Pyramid after Task Computing 6900**

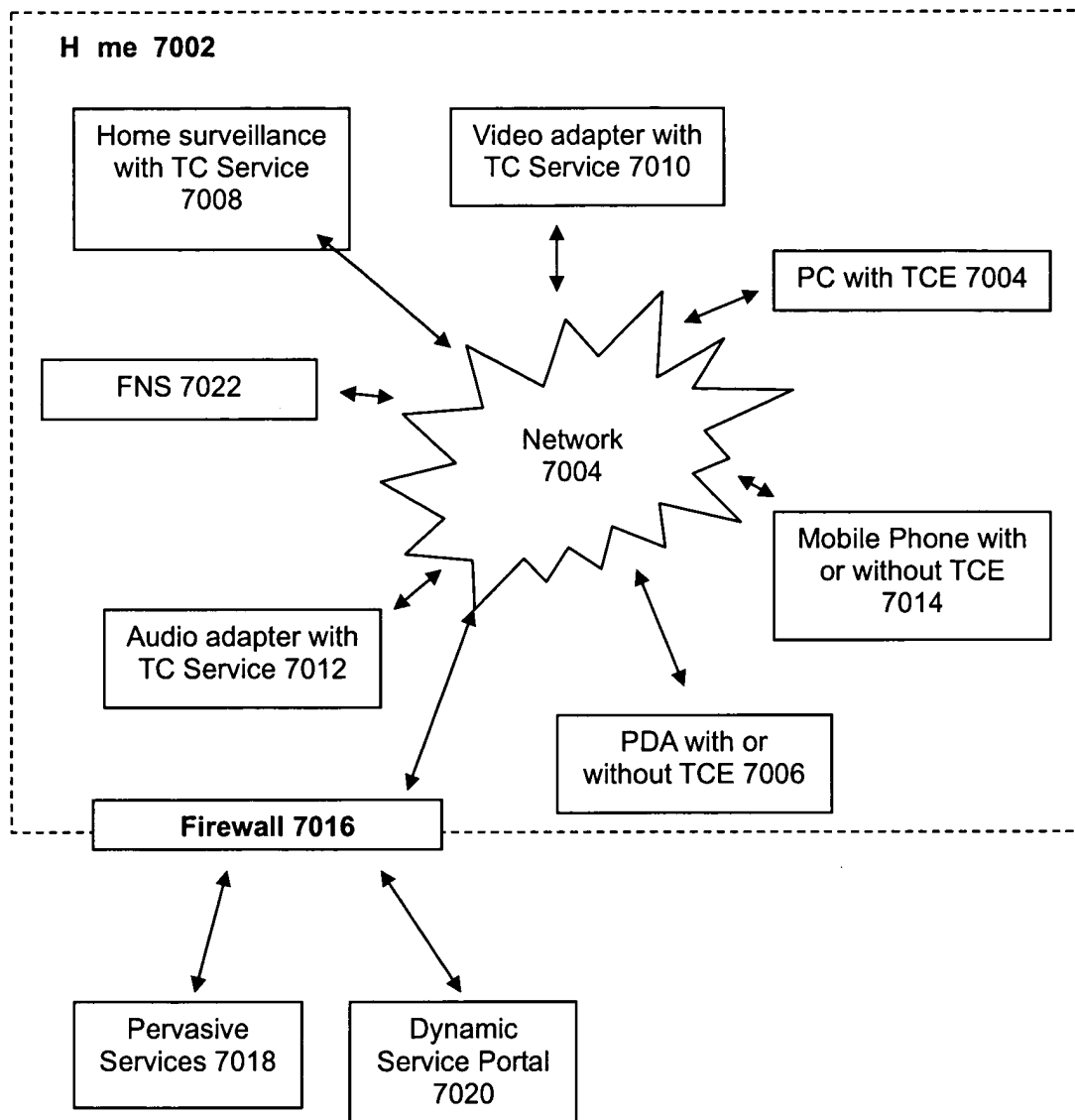


Figure 70 Application eHome 7000

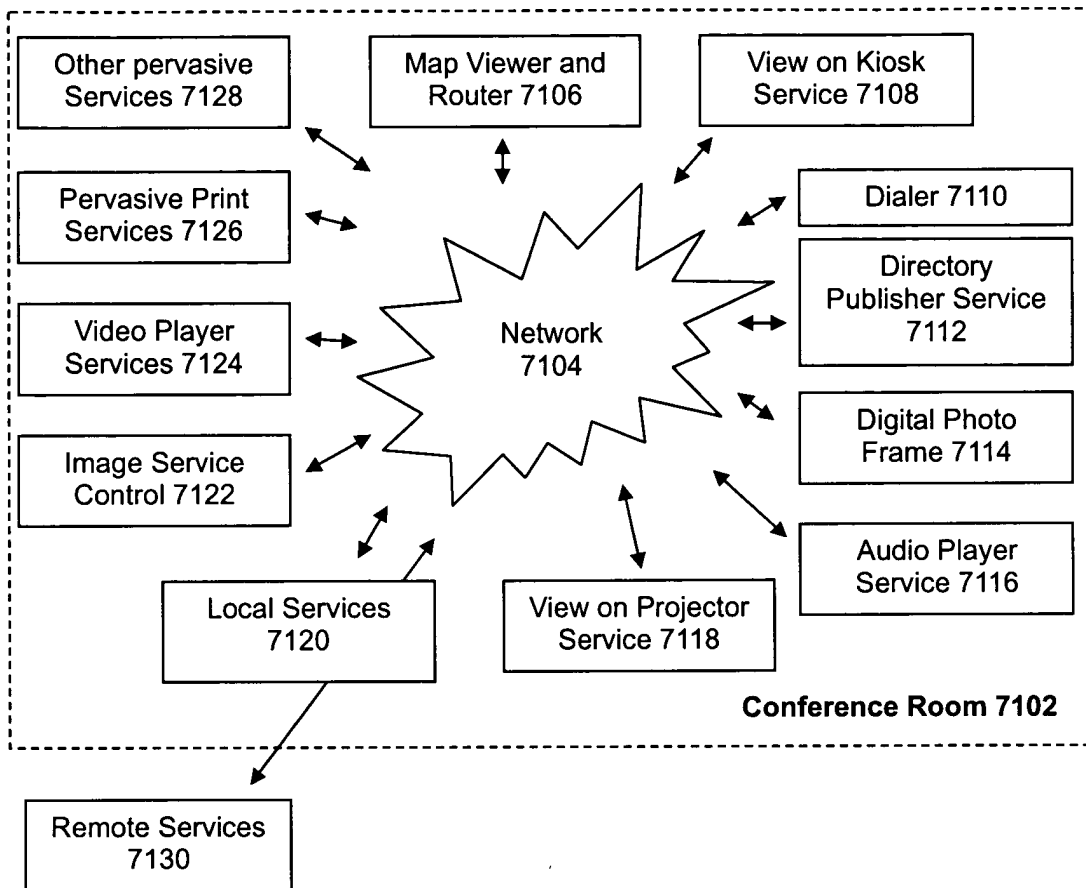


Figure 71 Application eOffice 7100

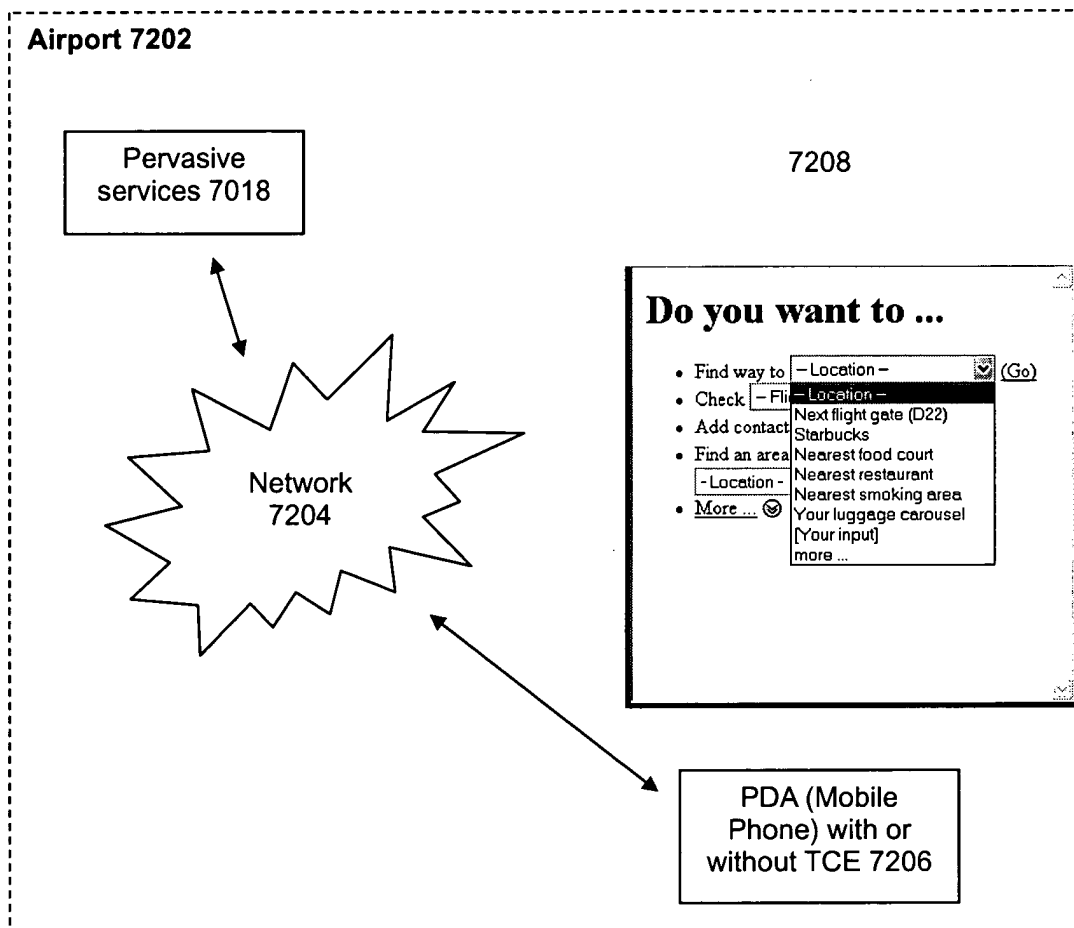
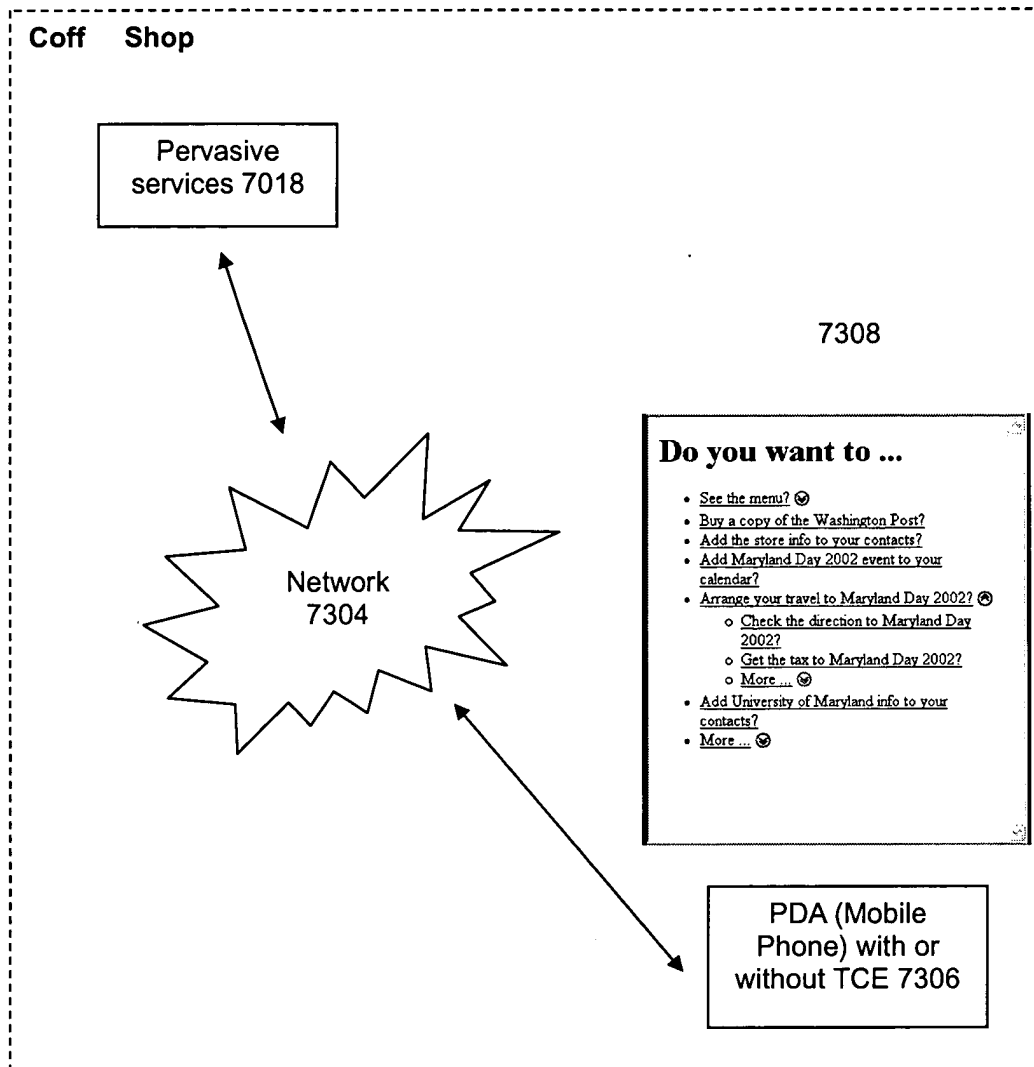


Figure 72 Application Airport 7200





**Figure 73 Application Coffee Shop 7300**

In this page you can find the following:

an *Event* of type *Talk* with  
**Title:** Signs of the Times: Information Technology in A Cautious Economy  
**Speaker:** Kathleen Hayes  
on **Date:** Tuesday, May 14, 2002  
with **Starting Time** of 08:00 AM  
and **Ending Time** of 10:00 AM  
at **Location** Baltimore Marriott Waterfront

---

☒ Would you like to *find the address* of **Baltimore Marriott Waterfront**

☐ Would you like to *add event to*

☐ Would you like to *send a note about this event to*

☐ Would you like to *find events* of type *talk* by *speaker* **Kathleen Hayes**

☐ Would you like to find events of type *talk* at *location* **Baltimore Marriott Waterfront**

Figure 74 The TCE Identifies what is been Described at the Webpage and Suggests to the User Some Possible Actions Given the Current Content and Context 7400

In this page you can find the following:

an *Event* of type *Talk* with

**Title:** Signs of the Times: Information Technology in A Cautious Economy

**Speaker:** Kathleen Hayes

on **Date:** Tuesday, May 14, 2002

with **Starting Time** of 08:00 AM

and **Ending Time** of 10:00 AM

at **Location** Baltimore Marriott Waterfront

with address 700 Aliceanna Street, Baltimore, MD 21202

☒ Would you like to *see directions* to **Baltimore Marriott Waterfront** from

☐ Would you like to *find*  *close to* **Baltimore Marriott Waterfront**

☐ Would you like to *add event* to

☐ Would you like to *send a note about this event* to

☐ Would you like to *find events* of type *talk* by *speaker* **Kathleen Hayes**

☐ Would you like to *find events* of type *talk* at *location* **Baltimore Marriott Waterfront**

You can save your actions so far as a task. Choose a name for this task

**Figure 75** After the User Chose to Find the Address of the Location of the Talk First, TCE Finds the Address and Presents the User with a New List of Possible Actions 7500

In this page you can find the following:

an Event of type *Talk* with  
**Title:** Signs of the Times: Information Technology in A Cautious Economy  
**Speaker:** Kathleen Hayes  
on **Date:** Tuesday, May 14, 2002  
with **Starting Time** of 08:00 AM  
and **Ending Time** of 10:00 AM  
at **Location** Baltimore Marriott Waterfront  
with **address** 700 Aliceanna Street, Baltimore, MD 21202

---

☒ Would you like to *add add event* to MS Outlook   
☒ *include directions* to Baltimore Marriott Waterfront from your home

☒ Would you like to *send a note about this event* to Ryu Masuoka   
☒ *include directions* to Baltimore Marriott Waterfront from FLA - College Park

☐ Would you like to *find events* of type *talk* by *speaker* Kathleen Hayes

☐ Would you like to find events of type *talk* at *location* Baltimore Marriott Waterfront

☐ Would you like to just *see directions* to Baltimore Marriott Waterfront from location

☐ Would you like to *find* places of interest  *close to* Baltimore Marriott Waterfront

You can save your actions so far as a task. Choose a name for this task

Figure 76 After the User Selected to Check the Location of the Address of the Location of the Talk on the Map, TCE Presents a Revised List of Actions with the Option to Save User's Actions up to This Point as a New Task for Future (re-)Use 7600